SUCCESSIVE DETECTION AND CANCELLATION FOR CELL PILOT DETECTION

[0001] The present application claims priority to provisional U.S. Application Serial No. 61/085,754, entitled "CELL PILOT DETECTION," filed August 1, 2008, assigned to the assignee hereof and incorporated herein by reference.

BACKGROUND

I. Field

[0002] The present disclosure relates generally to communication, and more specifically to techniques for detecting for cells in a wireless communication network.

II. Background

[0003] Wireless communication networks are widely deployed to provide various communication content such as voice, video, packet data, messaging, broadcast, etc. These wireless networks may be multiple-access networks capable of supporting multiple users by sharing the available network resources. Examples of such multiple-access networks include Code Division Multiple Access (CDMA) networks, Time Division Multiple Access (TDMA) networks, Frequency Division Multiple Access (FDMA) networks, Orthogonal FDMA (OFDMA) networks, and Single-Carrier FDMA (SC-FDMA) networks.

[0004] A wireless communication network may include a number of cells that can support communication for a number of user equipments (UEs). A UE may be within the coverage of one or more cells at any given moment, e.g., depending on the current UE location. The UE may not know which cells are within range. The UE may perform a search to detect for cells and to acquire timing and other information for the detected cells. It may be desirable to detect for cells in a manner to obtain good performance, e.g., to detect as many cells as possible.

SUMMARY

[0005] Techniques for performing cell detection with successive detection and cancellation (SDC) are described herein. For SDC, signals (e.g., pilots) from stronger

cells may be canceled from a received signal at a UE so that the interference from the stronger cells may be significantly reduced. Weaker cells may be detected as a result of the reduced interference from the stronger cells.

[0006] In one design, a UE may process a received signal to detect for a cell. The UE may process the received signal to detect for common pilots transmitted by cells with a reuse factor of one, for low reuse pilots transmitted by cells with a reuse factor greater than one, etc. The UE may determine whether the detected cell is sufficiently strong. If the cell is sufficiently strong, then the UE may cancel the interference due to the detected cell from the received signal to obtain an interference-canceled signal and may further process the interference-canceled signal to detect for another cell. In one design, the UE may detect for cells in a set of cells in a sequential order, from the strongest cell to the weakest cell. The UE may process the received signal to detect for the strongest cell in the set and may process the interference-canceled signal to detect for the second strongest cell in the set. The UE may terminate detection when a cell not sufficiently strong is detected or when all cells in the set have been detected.

[0007] Various aspects and features of the disclosure are described in further detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 shows a wireless communication network.

[0009] FIG. 2 shows a process for detecting for cells with SDC.

[0010] FIG. 3 shows another process for detecting for cells with SDC.

[0011] FIG. 4 shows a block diagram of a base station and a UE.

[0012] FIG. 5 shows a block diagram of a pilot processor/searcher.

[0013] FIG. 6 shows a process for performing cell detection with SDC.

[0014] FIG. 7 shows an apparatus for performing cell detection with SDC.

DETAILED DESCRIPTION

[0015] The techniques described herein may be used for various wireless communication networks such as CDMA, TDMA, FDMA, OFDMA, SC-FDMA and other networks. The terms "network" and "system" are often used interchangeably. A CDMA network may implement a radio technology such as Universal Terrestrial Radio

Access (UTRA), cdma2000, etc. UTRA includes Wideband CDMA (WCDMA) and other variants of CDMA. cdma2000 covers IS-2000, IS-95 and IS-856 standards. A TDMA network may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA network may implement a radio technology such as Evolved UTRA (E-UTRA), Ultra Mobile Broadband (UMB), IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDM®, etc. UTRA and E-UTRA are part of Universal Mobile Telecommunication System (UMTS). 3GPP Long Term Evolution (LTE) and LTE-Advanced (LTE-A) are new releases of UMTS that use E-UTRA, which employs OFDMA on the downlink and SC-FDMA on the uplink. UTRA, E-UTRA, UMTS, LTE, LTE-A and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 and UMB are described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). The techniques described herein may be used for the wireless networks and radio technologies mentioned above as well as other wireless networks and radio technologies.

[0016] **FIG. 1** shows a wireless communication network 100 with multiple base stations 110. A base station may be a station that communicates with the UEs and may also be referred to as a Node B, an evolved Node B (eNB), an access point, etc. Each base station 110 may provide communication coverage for a particular geographic area. In 3GPP, the term "cell" can refer to a coverage area of a base station and/or a base station subsystem serving this coverage area, depending on the context in which the term is used. In 3GPP2, the term "sector" or "cell-sector" can refer to a coverage area of a base station and/or a base station subsystem serving this coverage area. For clarity, 3GPP concept of "cell" is used in the description below. A base station may support one or multiple (e.g., three) cells.

[0017] Wireless network 100 may be a homogeneous network that includes base stations of one type, e.g., only macro base stations. Wireless network 100 may also be a heterogeneous network that includes base stations of different types, e.g., macro, pico, and/or femto base stations that provide coverage for macro, pico and/or femto cells, respectively. A macro base station may cover a relatively large geographic area (e.g., several kilometers in radius) and may allow unrestricted access by UEs with service subscription. A pico base station may cover a relatively small geographic area and may

allow unrestricted access by UEs with service subscription. A femto or home base station may cover a relatively small geographic area (e.g., a home) and may allow restricted access by UEs having association with the femto cell (e.g., UEs for users in the home). Wireless network 100 may also include relay stations. The techniques described herein may be used for both homogeneous and heterogeneous networks. A network controller 130 may couple to a set of base stations and provide coordination and control for the base stations.

[0018] UEs 120 may be dispersed throughout wireless network 100, and each UE may be stationary or mobile. A UE may also be referred to as a mobile station, a terminal, a subscriber unit, a station, etc. A UE may be a cellular phone, a personal digital assistant (PDA), a wireless modem, a wireless communication device, a handheld device, a laptop computer, a cordless phone, a wireless local loop (WLL) station, etc. A UE may communicate with a base station via the downlink and uplink. The downlink (or forward link) refers to the communication link from the base station to the UE, and the uplink (or reverse link) refers to the communication link from the UE to the base station. In FIG. 1, a solid line with a single arrow indicates a UE receiving a data transmission from a serving cell, and a dashed line with a single arrow indicates a UE receiving pilot from a cell. Uplink transmissions are not shown in FIG. 1.

[0019] Wireless network 100 may utilize a reuse factor of one, which means that a given frequency channel may be used by all cells in the wireless network. Using a reuse factor of one may improve spectral efficiency and may also reduce complexity of frequency planning in wireless network 100.

[0020] Each cell in wireless network 100 may transmit a common pilot, which may be used by UEs for cell detection, time synchronization, channel estimation, etc. A pilot is a signal or transmission that is known *a priori* by a transmitter and a receiver. A pilot may also be referred to as a reference signal, a preamble, etc. A common pilot is a pilot transmitted to all UEs. A common pilot may also be referred to as a cell-specific reference signal, etc.

[0021] A UE may have difficulty detecting the common pilots from neighboring cells due to strong interference from the closest cells. This near-far effect may result in a hearability problem, which may reduce accuracy of cellular network-based positioning of the UE. The hearability problem may be mitigated by increasing pilot processing gain, e.g., by transmitting more pilot symbols for the common pilots on more resources.

However, pilot processing gain may not be a feasible solution to the near-far problem due to physical resource limitation and/or channel coherence time.

[0022] In an aspect, a UE may perform successive detection and cancellation (SDC) to detect for cells in the wireless network. For SDC, the UE may process a received signal to detect for pilots from one or more cells. The UE may estimate the interference due to a detected cell (e.g., the strongest detected cell) and may cancel the estimated interference from the received signal. The UE may be able to detect pilots from more cells (e.g., from weaker cells) by canceling the interference due to the pilots from the detected cells. SDC may improve the hearability of weaker cells and may enable the UE to detect more cells. SDC may be used for both common pilots and low reuse pilots.

[0023] At a given UE, a received signal comprising pilot signals from different cells may be expressed as:

$$y(t) = \sum_{k \in \Omega} \sum_{\{\tau_k\}} \alpha_{\tau_k}^k \cdot x_k(t - \tau_k) + n(t) \ , \qquad \text{for } 0 < t < T_s \ , \qquad \text{Eq (1)}$$

where $x_k(t)$ is a pilot signal from cell k at time t, which is known to the UE,

$y(t)$ is the received signal at the UE,

T_s is the length of the pilot signal,

τ_k is the delay of a channel tap for cell k,

$\alpha_{\tau^k}^k$ is a complex gain of the channel tap for cell k at delay τ_k,

$\{\tau_k\}$ is a set of tap delays for cell k,

Ω is a set of cells of interest, e.g., cells to be detected, and

$n(t)$ is thermal noise at the UE.

[0024] A pilot signal may be a cell signature bearing pilot symbol and may span one OFDM symbol period, one time slot, or some other duration. A pilot signal may be generated in different manners for different systems.

[0025] The channel tap gain $\alpha_{\tau_k}^k$ may be assumed to be (i) Gaussian with zero mean and variance $\sigma_{\tau_k}^2$ and (ii) constant over the interval [0, T_s] of the pilot signals. The thermal noise $n(t)$ may be assumed to be additive white Gaussian noise (AWGN) with

zero mean and variance σ_n^2. The thermal noise may be small compared to the total received power at the UE and, for simplicity, may be ignored in much of the description below.

[0026] The UE may use a searcher to detect for pilots from cells. The searcher may correlate the received signal with a locally generated pilot signal for cell *k* to detect for cell *k*. The output of the searcher for cell *k* may be expressed as:

$$\begin{aligned} z_k(\tau) &= \frac{1}{T_s}\sum_{0<t<T_s} y(t+\tau)\cdot x_k^*(t) \\ &= \frac{1}{T_s}\sum_{0<t<T_s}\left(\sum_{j\in\Omega}\sum_{\{\tau_j\}}\alpha_{\tau_j}^j \cdot x_j(t+\tau-\tau_j)\cdot x_k^*(t)+n(t)\right), \\ &= \frac{1}{T_s}\sum_{j\in\Omega}\sum_{\{\tau_j\}}\alpha_{\tau_j}^j\sum_{0<t<T_s} x_j(t+\tau-\tau_j)\cdot x_k^*(t)+n(t) \end{aligned} \qquad \text{Eq (2)}$$

where $z_k(\tau)$ is the searcher output for cell *k* for time offset τ, and

" * " denotes a complex conjugate.

[0027] A search may be performed over a search window Φ, which may cover the duration of the pilot signals. The searcher output when $\tau \neq \tau_k$ may be expressed as:

$$z_0^k = \frac{\zeta}{T_s}\sum_{j\in\Omega}\sum_{\{\tau_j\}}\alpha_{\tau_j}^j + n(t)\ , \qquad \text{Eq (3)}$$

where ζ is defined below.

[0028] The searcher output when $\tau = \tau_k$ may be expressed as:

$$z_1^k = \frac{\zeta}{T_s}\sum_{j\in\Omega}\sum_{\tau_j\neq\tau_k}\alpha_{\tau_j}^j + \alpha_{\tau_k}^k + n(t)\ . \qquad \text{Eq (4)}$$

[0029] Equations (3) and (4) assume the following:

$$\sum_{0<t<T_s} x_j(t+\tau-\tau_j)\cdot x_k^*(t) = \begin{cases} T_s & \text{for } k=j \text{ and } \tau=\tau_j \\ \zeta & \text{otherwise}\ . \end{cases} \qquad \text{Eq (5)}$$

[0030] If the pilot signal for cell k is generated based on a pseudo-random number (PN) sequence, then $\zeta = -1$. Both z_0^k and z_1^k are Gaussian with zero mean and variances $\sigma_{z_0^k}^2$ and $\sigma_{z_1^k}^2$, respectively, which may be expressed as:

$$\sigma_{z_0^k}^2 = \left(\frac{\zeta}{T_s}\right)^2 \sum_{j\in\Omega}\sum_{\{\tau_j\}}\sigma_{\tau_j}^2 + \sigma_n^2 \quad , \text{ and} \qquad \text{Eq (6)}$$

$$\sigma_{z_1^k}^2 = \sigma_{\tau_k}^2 + \left(\frac{\zeta}{T_s}\right)^2 \sum_{j\in\Omega}\sum_{\tau_j\neq\tau_k}\sigma_{\tau_j}^2 + \sigma_n^2 \quad . \qquad \text{Eq (7)}$$

[0031] The UE may declare detection of cell k if the following condition is true:

$$|z_k(\tau)|^2 > \lambda_{\text{det}} \quad , \qquad \text{Eq (8)}$$

where λ_{det} is a detection threshold.

[0032] A detection probability P_d^k, which is the probability of detecting cell k when it is present, may be expressed as:

$$P_d^k = 1 - \exp\left(\frac{-\lambda}{2\sigma_{z_1^k}^2}\right) . \qquad \text{Eq (9)}$$

[0033] A false detection probability P_f^k, which is the probability of detecting cell k when it is not present, may be expressed as:

$$P_f^k = 1 - \exp\left(\frac{-\lambda}{2\sigma_{z_0^k}^2}\right) . \qquad \text{Eq (10)}$$

[0034] If cell k is much weaker than the other cells, e.g., if $\sigma_{\tau_k}^2 / \sigma_{\tau_j}^2 << 1$ and $\sigma_{z_1^k}^2 \approx \sigma_{z_0^k}^2$, then the detection probability for cell k may be small, and $P_d^k \approx P_f^k$.

[0035] SDC may be used to combat the near-far effect and increase hearability of cells. A processing/search window for SDC may be limited to $[\Delta, T_s - \delta]$, instead of the entire pilot signal interval $[0, T_s]$, in order to avoid inter-symbol interference. Δ is the front portion of the pilot signal that is not used for SDC in order to avoid time delay

spread from the pilot signal in the previous interval. δ is the end portion of the pilot signal to account for potential timing error to prevent the energy from the pilot signal in the next interval from leaking into the search window. For an OFDM system, the pilot signal may correspond to an OFDM symbol, and Δ may be equal to the cyclic prefix length. For simplicity, the received signal in the search window may be defined as:

$$r(t) = \sum_{k} \sum_{\tau_k} \alpha_{\tau_k}^{k} \cdot s_k(t - \tau_k) , \qquad \text{for } 0 < t < T_s' , \qquad \text{Eq (11)}$$

where $r(t) = y(t + \Delta)$, $s(t) = x(t + \Delta)$, and $T_s' = T_s - \Delta - \delta$.

[0036] In one design of SDC, the strongest cell may first be detected by scanning the received signal for each cell. For each cell *k*, the received signal may be correlated with the pilot signal for cell *k* at each time offset in the search window. The time offset $\hat{\tau}_k$ with the largest correlation result for cell *k* may be expressed as:

$$\hat{\tau}_k = \arg\max_{\tau \in \Phi} \left| \sum_{0 \le t \le T_s'} r(t) \cdot s_k^*(t - \tau) \right|^2 . \qquad \text{Eq (12)}$$

[0037] The channel gain $\hat{\alpha}_{\hat{\tau}_k}^{k}$ for cell *k* at time offset $\hat{\tau}_k$ may be expressed as:

$$\hat{\alpha}_{\hat{\tau}_k}^{k} = \frac{1}{T_s'} \sum_{0 \le t \le T_s'} r(t) \cdot s_k^*(t - \hat{\tau}_k) . \qquad \text{Eq (13)}$$

[0038] The interference $i_k(t)$ from cell *k* due to the channel tap at time offset $\hat{\tau}_k$ may be expressed as:

$$i_k(t) = \hat{\alpha}_{\hat{\tau}_k}^{k} \cdot s_k(t - \hat{\tau}_k) . \qquad \text{Eq (14)}$$

[0039] The interference from cell *k* may be canceled from the received signal to obtain an interference-canceled signal. The variance $\hat{\sigma}_{\hat{\tau}_k}^2$ of the residual interference may be estimated from the interference-canceled signal, as follows:

$$\hat{\sigma}_{\hat{\tau}_k}^2 = \frac{1}{T_s'} \sum_{0 \le t \le T_s'} | r(t) - i_k(t) |^2 . \qquad \text{Eq (15)}$$

[0040] A signal-to-noise-and-interference ratio (SINR) for cell k may be expressed as:

$$SINR_k = \frac{|\hat{\alpha}_{\hat{\tau}_k}^k|^2}{\hat{\sigma}_{\hat{\tau}_k}^2} . \quad \text{Eq (16)}$$

[0041] In one design, cell k may be deemed to be sufficiently strong if its SINR exceeds an SINR threshold λ, as follows:

$$SINR_k > \lambda . \quad \text{Eq (17)}$$

The test for whether cell k is sufficiently strong may also be based on other metrics, e.g., the detected energy of cell k, which may be $E_k = |\hat{\alpha}_{\hat{\tau}_k}^k|^2$.

[0042] If cell k is sufficiently strong, then the interference due to cell k may be canceled from the received signal, as follows:

$$r_k(t) = r(t) - i_k(t) , \qquad \text{for } 0 < t < T_s' , \quad \text{Eq (18)}$$

where $r_k(t)$ is an interference-canceled signal with the interference from cell k canceled.

[0043] In one design, cell k may be deemed to be sufficiently strong or not based on its SINR (or some other metric) for the time offset with the largest correlation result. If cell k is sufficiently strong, then the interference due to cell k may be canceled from the received signal. A channel profile for cell k may be estimated and used for position determination to estimate the location of the UE.

[0044] In another design, cell k may be deemed to be sufficiently strong or not based on its overall SINR (or some other metric), which may be determined based on all time offsets with sufficiently large correlation results. In this design, the SDC processing may be iterated for up to I times for cell k, where I may be any suitable value. In iteration i, where $0 < i \le I$, a channel tap at a new time offset $\hat{\tau}_{k,i}$ with the largest correlation result for cell k may be determined, as follows:

$$\hat{\tau}_{k,i} = \arg\max_{\tau \in \Phi} \left| \sum_{0 \le t \le T_s'} q_{k,i}(t) \cdot s_k^*(t-\tau) \right|^2 , \quad \text{Eq (19)}$$

where $q_{k,i}(t)$ is a received signal for iteration i for cell k. For the first iteration with $i=1$, $q_{k,1}(t)$ may be equal to (i) the received signal $r(t)$ if cell k is the first cell being detected or (ii) an interference-canceled signal after canceling interference from prior detected cells. For each subsequent iteration, $q_{k,i}(t)$ may be equal to an interference-canceled signal from a prior iteration for cell k.

[0045] A channel gain $\hat{\alpha}^k_{\hat{\tau}_{k,i}}$ for cell k at time offset $\hat{\tau}_{k,i}$ may be expressed as:

$$\hat{\alpha}^k_{\hat{\tau}_{k,i}} = \frac{1}{T_s'} \sum_{0 \le t \le T_s'} q_{k,i}(t) \cdot s_k^*(t - \hat{\tau}_{k,i}) \ . \qquad \text{Eq (20)}$$

[0046] The interference $i_{k,i}(t)$ from cell k due to the channel tap at time offset $\hat{\tau}_{k,i}$ may be expressed as:

$$i_{k,i}(t) = \hat{\alpha}^k_{\hat{\tau}_{k,i}} \cdot s_k(t - \hat{\tau}_{k,i}) \ . \qquad \text{Eq (21)}$$

[0047] The SINR for cell k at time offset $\hat{\tau}_{k,i}$ may be expressed as:

$$SINR_{k,i} = \frac{|\hat{\alpha}^k_{\hat{\tau}_{k,i}}|^2}{\hat{\sigma}^2_{\hat{\tau}_{k,i}}} = \frac{T_s' \, |\hat{\alpha}^k_{\hat{\tau}_{k,i}}|^2}{\sum_{0 \le t \le T_s'} |q_{k,i}(t) - i_{k,i}(t)|^2} \ . \qquad \text{Eq (22)}$$

[0048] The channel tap at time offset $\hat{\tau}_{k,i}$ may be deemed to be sufficiently strong if the following condition is true:

$$SINR_{k,i} > \lambda_1 \ , \qquad \text{Eq (23)}$$

where λ_1 is a threshold for identifying a sufficiently strong channel tap.

[0049] If the channel tap at time offset $\hat{\tau}_{k,i}$ is sufficiently strong, then the interference due to this channel tap may be canceled from the received signal, as follows:

$$q_{k,i+1}(t) = q_{k,i}(t) - i_{k,i}(t) \ , \qquad \text{for } 0 < t < T_s' \ , \qquad \text{Eq (24)}$$

where $q_{k,i+1}(t)$ is an interference-canceled signal for the next iteration. Otherwise, if the channel tap at time offset $\hat{\tau}_{k,i}$ is not sufficiently strong, then the processing for cell k may terminate.

[0050] The overall SINR for cell k may be determined based on all channel taps that are sufficiently strong, as follows:

$$SINR_{overall,k} = \sum_{\{\hat{\tau}_{k,i}\}} \frac{|\hat{\alpha}^k_{\hat{\tau}_{k,i}}|^2}{\hat{\sigma}^2_{\hat{\tau}_{k,i}}} = \sum_{\{\hat{\tau}_{k,i}\}} \frac{T_s' \, |\hat{\alpha}^k_{\hat{\tau}_{k,i}}|^2}{\sum_{0 \le t \le T_s'} |q_{k,i}(t)|^2} \ , \qquad \text{Eq (25)}$$

where $\{\hat{\tau}_{k,i}\}$ denotes a set of time offsets for cell k with sufficiently high SINR.

[0051] The overall SINR for cell k may be compared against a threshold λ_2, as follows:

$$SINR_{overall,k} > \lambda_2 \ . \qquad \text{Eq (26)}$$

[0052] If the condition in equation (26) is met, then cell k may be deemed to be sufficiently strong, and the interference due to cell k may be canceled from the received signal. A channel profile for cell k may be estimated and used for location estimation.

[0053] The interference-canceled signal for detecting the next cell may be expressed as:

$$r_k(t) = q_{k,1}(t) - \sum_{\{\hat{\tau}_{k,i}\}} \hat{\alpha}^k_{\hat{\tau}_{k,i}} \cdot s_k(t - \hat{\tau}_{k,i}) \ , \qquad \text{for } 0 < t < T_s' \ , \qquad \text{Eq (27)}$$

where $\{\hat{\tau}_{k,i}\}$ denotes a set of sufficiently strong channel taps for cell k, and

$q_{k,1}(t)$ is a received signal used to detect for strong channel taps for cell k.

[0054] The interference-canceled signal for detecting the next cell may also be expressed as:

$$r_k(t) = r(t) - \sum_{\{k\}} \sum_{\{\hat{\tau}_{k,i}\}} \hat{\alpha}^k_{\hat{\tau}_{k,i}} \cdot s_k(t - \hat{\tau}_{k,i}) \ , \qquad \text{for } 0 < t < T_s' \ , \qquad \text{Eq (28)}$$

where $\{k\}$ denotes a set of cells already detected.

[0055] The SDC processing described above may be repeated for all cells in set Ω. For position determination/location estimation, only cells located in different base

stations (i.e., non co-located cells) may be of interest. In this case, the detected cells may be examined, and only cells belonging to different base stations may be provided for position determination.

[0056] For simplicity, SDC processing for one search window has been described above. The search window may cover pilot signals in one interval, e.g., one OFDM symbol period, one time slot, etc. The SDC processing may be performed for multiple intervals to obtain time diversity and improve detection performance. The detected cells obtained over the multiple intervals may be provided as the search result.

[0057] **FIG. 2** shows a design of a process 200 for detecting for cells with SDC. Initially, a search may be performed to find the strongest cell k in set Ω (block 212). The search may be performed in different manners for different systems. In one design, correlation may be performed for each cell in set Ω at different time offsets, and the cell with the largest correlation result may be deemed as the strongest cell. The strongest cell may also be found in other manners and based on various metrics.

[0058] A determination may be made whether cell k is sufficiently strong (block 214). This may be achieved by comparing the SINR of cell k against a threshold, e.g., as shown in equation (17). Cell k may also be deemed to be sufficiently strong or not based on other metrics. If cell k is sufficiently strong, then interference from cell k may be estimated and canceled from the received signal (block 216). Cell k may then be removed from set Ω (block 218). A determination may then be made whether set Ω is empty (block 220). If set Ω is not empty, then the process may return to block 212 to find the next strongest cell in set Ω. Otherwise, if cell k is not sufficiently strong (as determined in block 214) or if set Ω is empty (as determined in block 220), then the process terminates.

[0059] For the design in FIG. 2, the cells in set Ω may be detected in a sequential order, starting with the strongest cell, then the next strongest cell, etc. For this design, if cell k is not sufficiently strong, then remaining cells would also not be sufficiently strong, and the process may terminate. Detecting for cells in a sequential order may improve interference cancellation.

[0060] **FIG. 3** shows a design of a process 300 for detecting for cells with SDC. Process 300 determines whether a cell is sufficiently strong based on all channel taps with sufficient energy for the cell. Initially, a search may be performed to find the

strongest cell k in set Ω (block 312). Strong channel taps for cell k may then be identified in an iterative manner.

[0061] Index i for iteration number may be initialized to 1 for the first iteration (block 314). Correlation may then be performed to detect for cell k at different time offsets within a search window (block 316). The time offset τ with the strongest channel tap may be identified (block 318). The SINR (or some other metric) may be determined for cell k at time offset τ (block 320). A determination may then be made whether the SINR is sufficiently high, e.g., larger than threshold λ_1 (block 322). If the SINR is sufficiently high, then the energy of cell k at time offset τ may be combined with the energy of other strong time offsets, if any (block 324). In one design, the interference due to cell k at time offset τ may be estimated and cancelled (block 326). This may improve detection of the next channel tap for cell k. In another design, interference cancellation is not performed for each channel tap and may instead be performed after all channel taps have been detected. In any case, a determination may be made whether all iterations have been performed for cell k (block 328). If the answer is 'no', then index i may be incremented (block 330), and the process may return to block 316 to detect for another strong channel tap for cell k.

[0062] If all iterations have been completed for cell k (as determined in block 328) or if the strongest time offset for cell k is not sufficiently strong (as determined in block 322), then the overall SINR of cell k may be determined based on all sufficiently strong channel taps for cell k (block 332). A determination may then be made whether the overall SINR is sufficiently high, e.g., larger than threshold λ_2 (block 334). If the overall SINR is sufficiently high, then the interference cancellation for cell k may be accepted (block 336). Otherwise, the interference cancellation for cell k may be skipped, and the received signal used for the first iteration for cell k in block 316 may be used for the next cell. In either case, cell k may be removed from set Ω (block 338). A determination may then be made whether set Ω is empty (block 340). If set Ω is not empty, then the process may return to block 312 to find the next strongest cell in set Ω. Otherwise, the process terminates.

[0063] FIGS. 2 and 3 show two exemplary designs of cell detection with SDC. These designs detect for cells in a sequential order, starting with the strongest cell. SDC may also be performed in other manners, as described below.

[0064] SDC may be used for various types of pilots transmitted by cells. For example, SDC may be used for common pilots, which may be transmitted periodically by cells with a reuse factor of one. SDC may also be used for low reuse pilots (LRPs), which may be transmitted by cells with a reuse factor greater than one, so that only a fraction of the cells may transmit their low reuse pilots on a given time and/or frequency resource. For example, with a reuse factor of M, where $M > 1$, only one out of every M cells may transmit its low reuse pilot on a given resource. A higher reuse factor (i.e., a larger value of M) corresponds to lower reuse, and vice versa. A low reuse pilot from a cell may observe less interference from low reuse pilots from other cells, which may enable detection of the low reuse pilot by more UEs. The low reuse pilots may thus have wider coverage and better hearability than the common pilots. A UE may be able to detect cells farther away based on the low reuse pilots transmitted by these cells. A low reuse pilot may also be referred to as a highly detectable pilot (HDP), a positioning assistance reference signal (PA-RS), a low reuse preamble, etc.

[0065] In one design, certain time slots may be reserved for low reuse pilots, or HDP. A given cell *x* may transmit its low reuse pilot in some of the reserved time slots. For example, M time slots may be reserved for low reuse pilots in each pilot cycle. Cell *x* may pseudo-randomly select one of the M reserved time slots and may transmit its low reuse pilot in the selected time slot.

[0066] In another design, certain subframes may be reserved for low reuse pilots, or PA-RS. Cell *x* may transmit its PA-RS in each symbol period not use for the reference signal or control information in a reserved subframe. In each symbol period with a PA-RS transmission, cell *x* may transmit the PA-RS on every sixth subcarrier starting with a particular subcarrier. Different starting subcarriers may be used in different PA-RS symbol periods to allow the PA-RS to be transmitted on all or most of the N_{FFT} total subcarriers. The starting subcarriers may change over time to avoid continual collision with the PA-RS from the same strong neighbor cell. Cell *x* may generate an OFDM symbol comprising a PA-RS transmission in each symbol period that may be used for the PA-RS.

[0067] In general, low reuse pilots use multiplexing to reduce the chances of collision between pilots from strong cells and pilots from weak cells. This may then increase the opportunity for weak cells to be heard. This requires the wireless network

to support a low reuse pilot for each cell. SDC may improve the hearability of weak cells without assistance from the wireless network.

[0068] Detection performance with SDC and/or low reuse pilots was ascertained via computer simulation. The computer simulation models a cellular network with 37 base stations, with each base station having three cells, and each cell having a radius of 750 meters. In the simulation, each cell transmits a common pilot with a reuse factor of one and a low reuse pilot with a reuse factor of greater than one. A number of UEs are randomly placed throughout the center cell in the cellular network. Each UE can detect for the common pilots or the low reuse pilots with or without SDC.

[0069] The computer simulation indicates that the hearability of the common pilots without SDC is generally poor. UEs located near the middle of a given cell x can detect only one or few cells due to strong interference from cell x. UEs located at the edges of cell x may be able to detect more cells due to less interference from cell x. The computer simulation indicates that the hearability with SDC may be better than the hearability with the low reuse pilots, except at locations close to cell x transmitter. The computer simulation also indicates that the hearability of the low reuse pilots with SDC is much improved over both (i) the hearability of the low reuse pilots without SDC (ii) the hearability of the common pilots with SDC.

[0070] SDC may thus be used to improve detection performance and may be applicable for both the common pilots and the low reuse pilots. SDC can provide good detection performance even with a small reuse factor. It can be shown that detection performance for the low reuse pilots with $M = 4$ and SDC is better than detection performance for the low reuse pilots with $M = 8$ and no SDC. SDC may thus be used to improve detection performance and/or reduce the reuse factor M.

[0071] The cell detection techniques described herein may be used for various applications such as positioning of UEs. A UE may detect for pilots (e.g., common pilots and/or low reuse pilots) from different cells with SDC to increase the number of cells that can be detected. The UE may obtain a time measurement (e.g., a time of arrival (TOA) measurement) based on the pilot from each detected cell. A location estimate for the UE may be derived based on the time measurements for the detected cells and their known locations using trilateration. The accuracy of the location estimate may improve and the location error may reduce with more detected cells.

[0072] **FIG. 4** shows a block diagram of a design of a base station 110 and a UE 120, which may be one of the base stations and one of the UEs in FIG. 1. Base station 110 may support one or more cells. Base station 110 may be equipped with T antennas 434a through 434t, and UE 120 may be equipped with R antennas 452a through 452r, where in general $T \geq 1$ and $R \geq 1$.

[0073] At base station 110, a transmit processor 420 may receive data for one or more UEs from a data source 412, process (e.g., encode, interleave, and symbol map) the data for each UE, and provide data symbols for all UEs. Transmit processor 420 may also process control information from a controller/processor 440 and provide control symbols. Transmit processor 420 may also generate pilot symbols for a common pilot, a low reuse pilot, and/or other pilots or reference signals for each cell supported by base station 110. A transmit (TX) multiple-input multiple-output (MIMO) processor 430 may perform precoding on the data symbols, the control symbols, and/or the pilot symbols, if applicable. Processor 430 may provide T output symbol streams to T modulators (MODs) 432a through 432t. Each modulator 432 may process a respective output symbol stream (e.g., for OFDM, CDMA, etc.) to obtain an output sample stream. Each modulator 432 may further process (e.g., convert to analog, amplify, filter, and upconvert) the output sample stream to obtain a downlink signal. T downlink signals from modulators 432a through 432t may be transmitted via T antennas 434a through 434t, respectively.

[0074] At UE 120, antennas 452a through 452r may receive the downlink signals from base station 110 and other base stations and may provide received signals to demodulators (DEMODs) 454a through 454r, respectively. Each demodulator 454 may condition (e.g., filter, amplify, downconvert, and digitize) a respective received signal to obtain input samples. Each demodulator 454 may further process the input samples (e.g., for OFDM, CDMA, etc.) to obtain received symbols. A MIMO detector 456 may obtain received symbols from all R demodulators 454a through 454r, perform receiver spatial processing on the received symbols if applicable, and provide detected symbols. A receive processor 458 may process (e.g., demodulate, deinterleave, and decode) the detected symbols, provide decoded data for UE 120 to a data sink 460, and provide decoded control information to a controller/processor 480. A pilot processor/searcher 484 may receive input samples from all demodulators 454 and may detect for pilots from cells, as described below.

[0075] On the uplink, at UE 120, a transmit processor 464 may receive and process data from a data source 462 and control information (e.g., for detected cells, time measurements, etc.) from controller/processor 480. Transmit processor 464 may also generate pilot symbols. The symbols from transmit processor 464 may be precoded by a TX MIMO processor 466 if applicable, further processed by modulators 454a through 454r, and transmitted to base station 110. At base station 110, the uplink signals from UE 120 and other UEs may be received by antennas 434, processed by demodulators 432, detected by a MIMO detector 436 if applicable, and further processed by a receive processor 438 to obtain decoded data and control information transmitted by the UEs.

[0076] Controllers/processors 440 and 480 may direct the operation at base station 110 and UE 120, respectively. Memories 442 and 482 may store data and program codes for base station 110 and UE 120, respectively. A scheduler 444 may schedule UEs for data transmission on the downlink and/or uplink and may provide resource grants for the scheduled UEs.

[0077] **FIG. 5** shows a block diagram of a design of pilot processor/searcher 484 at UE 120 in FIG. 4. In this design, pilot processor 484 may perform cell detection with SDC in multiple stages 510. For simplicity, only two stages 510a and 510b are shown in FIG. 5.

[0078] In the first stage 510a, a pilot detector 512a may receive the input samples from demodulators 454, detect for pilots (e.g., common pilots and/or low reuse pilots) transmitted by cells based on the input samples, and provide the strength and timing of each detected cell. Pilot detector 512a may detect for pilots in a manner that is dependent on how the pilots are generated and transmitted by the cells. In one design, pilot detector 512a may locally generate a sample sequence for a pilot from a cell to be detected, which is referred to as a pilot signal in the description above. The locally generated sample sequence may be for a PN sequence assigned to the cell in HRPD, an OFDM symbol comprising a PA-RS transmission in LTE, etc. Pilot detector 512a may correlate the input samples with the locally generated sample sequence at different time offsets to obtain correlation results for different time offsets for the cell. Pilot detector 512a may identify a sufficiently strong cell based on the correlation results, as described above. In one design, UE 120 may receive a set of cells (e.g., from a serving cell), and pilot detector 512a may detect for each cell in the set. In another design, pilot detector 512a may detect for each possible cell by cycling through all possible cell IDs, e.g., all

504 cell IDs in LTE. For all designs, pilot detector 512a may provide a list of detected cells, the SINR (or energy) and timing of each detected, and/or other information.

[0079] A sorter 514a may receive the search results from pilot detector 512a and may sort the SINRs of the detected cells. Sorter 514a may select one or more detected cells for interference cancellation and may provide the identity of each selected cell to an interference estimator 516a. Sorter 514a may select the strongest cell (or one or more cells based on one or more criteria) for interference cancellation.

[0080] Interference estimator 516a may receive the selected cell(s) from sorter 514a and the input samples and may estimate the interference due to the pilot from each selected cell. To estimate the interference due to a given selected cell, interference estimator 516a may derive a channel estimate for the selected cell based on the input samples (e.g., using the common pilot transmitted by the cell). Interference estimator 516a may locally generate the pilot from the selected cell in the same manner as the cell and may apply the locally generated pilot through the channel estimate to obtain an interference estimate. The accuracy of the interference estimate may be dependent on the accuracy of the channel estimate, which may be better for a strong cell and/or after canceling interference from a strong cell.

[0081] An interference canceller 518a may receive the input samples and the estimated interference for each selected cell from interference estimator 516a. Interference canceller 518a may subtract the estimated interference for each selected cell from the input samples and may provide interference-canceled samples to the second stage 510b.

[0082] Second stage 510b includes a pilot detector 512b, a sorter 514b, an interference estimator 516b, and an interference canceller 518b that may operate on the interference-canceled samples in similar manner as the corresponding units in the first stage 510a. Pilot detector 512b may detect for pilots (e.g., common pilots and/or low reuse pilots) from cells not detected or not canceled in the first stage 510a. Sorter 514b may select one or more detected cells for interference cancellation. Interference estimator 516b may estimate the interference due to each selected cell. Interference canceller 518b may cancel the estimated interference for each selected cell from the interference-canceled samples and may provide new interference-canceled samples to the next stage.

[0083] In general, pilot processor 484 may include any number of stages 510 and may operate in various manners. For SDC, pilot processor 484 may sort the SINRs (or energies) of all detected cells in each stage and may select the strongest detected cell for interference cancellation in that stage. Detection performance may improve by canceling the interference from the strongest cell in each stage and then processing the interference-canceled samples in the next stage. This may result in a more accurate estimate of the interference from the strongest cell detected in the next stage based on the interference-canceled samples having low interference from the strongest cell detected in each prior stage.

[0084] In another design, pilot processor 484 may perform interference cancellation for all detected cells in each stage. For each stage, pilot processor 484 may estimate the interference due to each detected cell in that stage, cancel the interference due to all detected cells, and provide interference-canceled samples to the next stage. In yet another design, pilot processor 484 may perform interference cancellation for a predetermined number of strongest detected cells in each stage. In yet another design, pilot processor 484 may perform interference cancellation for all detected cells with energies exceeding a threshold in each stage. The threshold may be a fixed value that can provide good performance. The threshold may also be a configurable value, which may be set to a particular percentage of the total received energy of the UE. Pilot processor 484 may also perform SDC in other manners.

[0085] Pilot processor 484 may perform cell detection with SDC in multiple stages, e.g., as shown in FIG. 5. Pilot processor 484 may provide search results for one or more detected cells in each stage and may also cancel the interference from one or more selected cells in each stage. Pilot processor 484 may repeat the SDC processing until a termination condition is encountered. This termination condition may occur when a target number of cells have been detected, when all cells in the set have been detected, when pilot processor 484 cannot detect any more cells, etc.

[0086] **FIG. 6** shows a design of a process 600 for performing cell detection with SDC. Process 600 may be performed by a UE (as described below) or by some other entity. The UE may process a received signal to detect for a cell (block 612). The UE may process the received signal to detect for common pilots transmitted by cells with a reuse factor of one, for low reuse pilots transmitted by cells with a reuse factor greater than one, or for some other signals transmitted by the cells. The UE may determine

whether the detected cell is sufficiently strong (block 614). The UE may cancel the interference due to the detected cell from the received signal to obtain an interference-canceled signal if the detected cell is sufficiently strong (block 616). The UE may process the interference-canceled signal to detect for another cell if the detected cell is sufficiently strong (block 618). The UE may skip the interference cancellation for the detected cell if it is not sufficiently strong.

[0087] In one design, the UE may detect for cells in a set of cells in a sequential order, from the strongest cell to the weakest cell. The set of cells may be a candidate set sent by a serving cell, a set of all possible cells, etc. For block 612, the UE may detect for the strongest cell in the set. For block 618, the UE may process the interference-canceled signal to detect for the second strongest cell in the set. The UE may determine whether the second strongest cell is sufficiently strong. The UE may cancel the interference due to the second strongest cell from the interference-canceled signal to obtain a second interference-canceled signal if the second strongest cell is sufficiently strong. The UE may then process the second interference-canceled signal to detect for the next strongest cell in the set. The UE may terminate detection when a cell not sufficiently strong is detected or when all cells in the set have been detected.

[0088] In one design of block 612, the UE may perform correlation on the received signal at different time offsets to identify channel taps for the cell. The UE may then detect for the cell based on the identified channel taps.

[0089] In one design of block 614, the UE may determine a metric for the detected cell. The metric may comprise an SINR of the cell, received energy of the cell, etc. The UE may compare the metric against a threshold and may declare the cell to be sufficiently strong if the metric exceeds the threshold. In one design, the UE may determine the metric for the cell based on only the strongest channel tap for the cell. In another design, the UE may determine the metric for the cell based on all sufficiently strong channel taps identified for the cell. The UE may determine whether a given channel tap is sufficiently strong based on a second metric (e.g., an SINR) for the channel tap and a second threshold. The UE may identify channel taps for the detected cell in a sequential order, from the strongest channel tap to the weakest channel tap, and may terminate processing for the detected cell when an identified channel tap is not sufficiently strong. The UE may perform interference cancellation (i) after each sufficiently strong channel tap is identified or (ii) after all channel taps are identified.

[0090] In one design of block 616, the UE may derive a channel estimate for the detected cell based on the received signal. The UE may generate a pilot signal for the detected cell and may estimate the interference due to the detected cell based on the pilot signal and the channel estimate for the detected cell. The UE may then cancel the estimated interference from the received signal.

[0091] In one design, the UE may obtain time measurements for multiple detected cells and may obtain a location estimate for itself based on the time measurements. In another design, the UE may identify multiple detected cells and may obtain a location estimate for itself based on the identities of the detected cells. For both designs, the location estimate may have improved accuracy due to a higher number of detected cells with SDC.

[0092] **FIG. 7** shows a design of an apparatus 700 for performing cell detection. Apparatus 700 includes a module 712 to process a received signal to detect for a cell, a module 714 to determine whether the detected cell is sufficiently strong, a module 716 to cancel the interference due to the detected cell from the received signal to obtain an interference-canceled signal if the detected cell is sufficiently strong, and a module 718 to process the interference-canceled signal to detect for another cell if the detected cell is sufficiently strong.

[0093] The modules in FIG. 7 may comprise processors, electronics devices, hardware devices, electronics components, logical circuits, memories, software codes, firmware codes, etc., or any combination thereof.

[0094] Those of skill in the art would understand that information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0095] Those of skill would further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the disclosure herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is

implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present disclosure.

[0096] The various illustrative logical blocks, modules, and circuits described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0097] The steps of a method or algorithm described in connection with the disclosure herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal.

[0098] In one or more exemplary designs, the functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage

media may be any available media that can be accessed by a general purpose or special purpose computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code means in the form of instructions or data structures and that can be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blu-ray disc where *disks* usually reproduce data magnetically, while *discs* reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media.

[0099] The previous description of the disclosure is provided to enable any person skilled in the art to make or use the disclosure. Various modifications to the disclosure will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other variations without departing from the spirit or scope of the disclosure. Thus, the disclosure is not intended to be limited to the examples and designs described herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

CLAIMS

1. A method of detecting for cells in a wireless network, comprising:

processing a received signal to detect for a cell;

determining whether the detected cell is sufficiently strong; and

if the detected cell is sufficiently strong,

canceling interference due to the detected cell from the received signal to obtain an interference-canceled signal, and

processing the interference-canceled signal to detect for another cell.

2. The method of claim 1, wherein the processing the received signal comprises processing the received signal to detect for a strongest cell in a set of cells.

3. The method of claim 2, wherein the processing the interference-canceled signal comprises

processing the interference-canceled signal to detect for a second strongest cell in the set of cells,

determining whether the second strongest cell is sufficiently strong, and

if the second strongest cell is sufficiently strong,

canceling interference due to the second strongest cell from the interference-canceled signal to obtain a second interference-canceled signal, and

processing the second interference-canceled signal to detect for a next strongest cell in the set of cells.

4. The method of claim 2, wherein the cells in the set are detected in a sequential order, from the strongest cell to a weakest cell, and wherein detection terminates when a cell not sufficiently strong is detected or when all cells in the set have been detected.

5. The method of claim 1, further comprising:

skipping interference cancellation for the detected cell if not sufficiently strong.

6. The method of claim 1, wherein the processing the received signal comprises

performing correlation on the received signal at different time offsets to identify channel taps for the cell, and

detecting for the cell based on the identified channel taps.

7. The method of claim 1, wherein the determining whether the detected cell is sufficiently strong comprises

determining a metric for the detected cell,

comparing the metric against a threshold, and

declaring the cell to be sufficiently strong if the metric exceeds the threshold.

8. The method of claim 7, wherein the metric comprises a signal-to-noise-and-interference ratio (SINR) of the cell.

9. The method of claim 7, wherein the metric comprises received energy of the cell.

10. The method of claim 7, wherein the determining the metric for the detected cell comprises determining the metric for the cell based on a strongest channel tap for the cell.

11. The method of claim 7, wherein the determining the metric for the detected cell comprises determining the metric for the cell based on all sufficiently strong channel taps identified for the cell.

12. The method of claim 11, wherein the determining the metric for the detected cell further comprises determining whether a channel tap is sufficiently strong based on a second metric for the channel tap and a second threshold.

13. The method of claim 11, wherein channel taps for the detected cell are identified in a sequential order, from a strongest channel tap to a weakest channel tap,

and wherein processing for the detected cell terminates when an identified channel tap is not sufficiently strong.

14. The method of claim 13, further comprising:

performing interference cancellation after each sufficiently strong channel tap for the detected cell is identified.

15. The method of claim 1, wherein the canceling interference due to the detected cell comprises

deriving a channel estimate for the detected cell based on the received signal,

generating a pilot signal for the detected cell,

estimating interference due to the detected cell based on the pilot signal and the channel estimate for the detected cell, and

canceling the estimated interference from the received signal.

16. The method of claim 1, wherein the received signal is processed to detect for common pilots transmitted by cells with a reuse factor of one.

17. The method of claim 1, wherein the received signal is processed to detect for low reuse pilots transmitted by cells with a reuse factor greater than one.

18. The method of claim 1, further comprising:

obtaining time measurements for multiple detected cells; and

obtaining a location estimate for a user equipment (UE) based on the time measurements for the multiple detected cells, the location estimate having improved accuracy due to a higher number of detected cells with interference cancellation.

19. The method of claim 1, further comprising:

identifying multiple detected cells; and

obtaining a location estimate for a user equipment (UE) based on identities of the multiple detected cells, the location estimate having improved accuracy due to a higher number of detected cells with interference cancellation.

20. An apparatus for wireless communication, comprising:

means for processing a received signal to detect for a cell;

means for determining whether the detected cell is sufficiently strong;

means for canceling interference due to the detected cell from the received signal to obtain an interference-canceled signal if the detected cell is sufficiently strong; and

means for processing the interference-canceled signal to detect for another cell if the detected cell is sufficiently strong.

21. The apparatus of claim 20, wherein the means for processing the received signal comprises means for processing the received signal to detect for a strongest cell in a set of cells, and wherein the means for processing the interference-canceled signal comprises

means for processing the interference-canceled signal to detect for a second strongest cell in the set of cells,

means for determining whether the second strongest cell is sufficiently strong,

means for canceling interference due to the second strongest cell from the interference-canceled signal to obtain a second interference-canceled signal if the second strongest cell is sufficiently strong, and

means for processing the second interference-canceled signal to detect for a next strongest cell in the set of cells if the second strongest cell is sufficiently strong.

22. The apparatus of claim 21, wherein the cells in the set are detected in a sequential order, from the strongest cell to a weakest cell, and wherein detection terminates when a cell not sufficiently strong is detected or when all cells in the set have been detected.

23. The apparatus of claim 20, wherein the means for determining whether the detected cell is sufficiently strong comprises

means for determining a metric for the detected cell,

means for comparing the metric against a threshold, and

means for declaring the cell to be sufficiently strong if the metric exceeds the threshold.

24. The apparatus of claim 23, wherein the means for determining the metric for the detected cell comprises means for determining the metric for the cell based on all sufficiently strong channel taps identified for the cell.

25. An apparatus for wireless communication, comprising:

at least one processor configured to process a received signal to detect for a cell, to determine whether the detected cell is sufficiently strong, to cancel interference due to the detected cell from the received signal to obtain an interference-canceled signal if the detected cell is sufficiently strong, and to process the interference-canceled signal to detect for another cell if the detected cell is sufficiently strong.

26. The apparatus of claim 25, wherein the at least one processor is configured to process the received signal to detect for a strongest cell in a set of cells, to process the interference-canceled signal to detect for a second strongest cell in the set of cells, to determine whether the second strongest cell is sufficiently strong, to cancel interference due to the second strongest cell from the interference-canceled signal to obtain a second interference-canceled signal if the second strongest cell is sufficiently strong, and to process the second interference-canceled signal to detect for a next strongest cell in the set of cells if the second strongest cell is sufficiently strong.

27. The apparatus of claim 26, wherein the at least one processor is configured to detect for the cells in the set in a sequential order, from the strongest cell to a weakest cell, and to terminate detection for the cells when a cell not sufficiently strong is detected or when all cells in the set have been detected.

28. The apparatus of claim 25, wherein the at least one processor is configured to determine a metric for the detected cell, to compare the metric against a threshold, and to declare the cell to be sufficiently strong if the metric exceeds the threshold.

29. The apparatus of claim 28, wherein the at least one processor is configured to determine the metric for the cell based on all sufficiently strong channel taps identified for the cell.

30. A computer program product, comprising:

a computer-readable medium comprising:

code for causing at least one computer to process a received signal to detect for a cell,

code for causing the at least one computer to determine whether the detected cell is sufficiently strong,

code for causing the at least one computer to cancel interference due to the detected cell from the received signal to obtain an interference-canceled signal if the detected cell is sufficiently strong, and

code for causing the at least one computer to process the interference-canceled signal to detect for another cell if the detected cell is sufficiently strong.