CLAIMS

~~What is claimed is:~~

1. ——A method for radar signaling implemented by a user equipment (UE~~),~~) in a wireless communications system, comprising:

~~identifying a set of chirps~~ synchronizing the UE to a common timing associated with the wireless communications system; and transmitting a frequency modulated continuous wave (FMCW) waveform~~;~~

~~determining~~ using a phase code for a set of chirps of the FMCW waveform based at least in part on the synchronizing, the phase code determined for the set of chirps based at least in part on a codeword of a codebook~~; and~~, wherein the codeword is associated with the FMCW waveform.

~~transmitting the FMCW waveform using the phase code.~~

2. ————The method of claim 1, further comprising:

varying waveform shape parameters of the FMCW waveform over a subset of the set of chirps.

3.——— The method of claim 2, wherein the waveform shape parameters comprise a slope ß, a frequency offset f0, or a combination thereof.

4. ————The method of claim 3, wherein the varying the waveform shape parameters of the FMCW waveform over the subset of the set of chirps comprises:

selecting the slope ß for the subset of the set of chirps such that the slope ß is different from a second slope ß for a second FMCW waveform transmission by a second UE overlapping in time.

5.——— The method of claim 3, wherein the varying the waveform shape parameters of the FMCW waveform over the subset of the set of chirps comprises:

identifying that the slope ß for the subset of the set of chirps is the same as a second slope ß for a second FMCW waveform transmission by a second UE overlapping in time; and

selecting the frequency offset f0 for the subset of the set of chirps such that an interference peak of the second UE appears beyond a range of interest based at least in part on the identifying that the slope ß is the same.

6. The method of claim 3, ~~wherein the determining the phase code for the set of chirps comprises:~~

further comprising: identifying a correspondence between the slope ß and the frequency offset f0 for the subset of the set of chirps and a second slope ß and a second frequency offset f0 for a second FMCW waveform transmission by a second UE, the first and second FMCW waveform transmissions overlapping in time; and

determining the phase code such that phase modulation for the subset of the set of chirps is different from a second phase modulation for the second FMCW waveform transmission by the second UE based at least in part on the identifying the correspondence.

7. The method of claim 1, further comprising:

determining waveform shape parameters for the FMCW waveform over the set of chirps based at least in part on the codeword of the codebook.

8. The method of claim 1, wherein the phase code comprises a Zadoff-Chu sequence.

9. The method of claim 1, wherein the set of chirps comprises a first number of chirps and a length of the phase code is less than or equal to the first number of chirps.

10. The method of claim 1, ~~further comprising:~~

wherein the synchronizing comprises: synchronizing at least one chirp transmission boundary for the transmitting the FMCW waveform using the phase code with a chirp transmission boundary for a second FMCW waveform transmission by a second UE using a second phase code.

11. The method of claim 10, further comprising:

deriving the common timing using coordinated universal time (UTC); and

adding the common timing to the set of chirps, wherein the synchronizing is based at least in part on the adding the common timing.

12. ———The method of claim 1, further comprising:
selecting the codeword of the codebook based at least in part on phase code information for a second UE, wherein the codeword indicates phase code information for the phase code of the UE different from the phase code information for the second UE.

13. ———The method of claim 12, wherein the selecting the codeword comprises:
selecting the codeword such that a distance between the codeword and a second codeword for the second UE is maximized.

14.——— An apparatus for radar signaling implemented by a user equipment (UE~~),~~) in a wireless communications system, comprising:

a processor;

memory coupled with the processor; and

instructions stored in the memory and executable by the processor to cause the apparatus to:

~~identify a set of chirps~~ synchronize the UE to a common timing associated with the wireless communications system; and transmit a frequency modulated continuous wave (FMCW) waveform~~;~~

~~determine~~ using a phase code for a set of chirps of the FMCW waveform based at least in part on the synchronizing, the phase code determined for the set of chirps based at least in part on a codeword of a codebook~~; and~~, wherein the codeword is associated with the FMCW waveform.

~~transmit the FMCW waveform using the phase code.~~

15.—— The apparatus of claim 14, wherein the instructions are further executable by the processor to cause the apparatus to vary waveform shape parameters of the FMCW waveform over a subset of the set of chirps.

16.—— The apparatus of claim 15, wherein the waveform shape parameters comprise a slope ß, a frequency offset f0, or a combination thereof.

17. The apparatus of claim 16, wherein the instructions to vary the waveform shape parameters of the FMCW waveform over the subset of the set of chirps are further executable by the processor to cause the apparatus to select the slope ß for the subset of the set of chirps such that the slope ß is different from a second slope ß for a second FMCW waveform transmission by a second UE overlapping in time.

18. The apparatus of claim 16, wherein the instructions to vary the waveform shape parameters of the FMCW waveform over the subset of the set of chirps are further executable by the processor to cause the apparatus to:

identify that the slope ß for the subset of the set of chirps is the same as a second slope ß for a second FMCW waveform transmission by a second UE overlapping in time; and

select the frequency offset f0 for the subset of the set of chirps such that an interference peak of the second UE appears beyond a range of interest based at least in part on the identifying that the slope ß is the same.

19. The apparatus of claim 16, wherein the instructions ~~to determine the phase code for the set of chirps~~ are further executable by the processor to cause the apparatus to:

identify a correspondence between the slope ß and the frequency offset f0 for the subset of the set of chirps and a second slope ß and a second frequency offset f0 for a second FMCW waveform transmission by a second UE, the first and second FMCW waveform transmissions overlapping in time; and

determine the phase code such that phase modulation for the subset of the set of chirps is different from a second phase modulation for the second FMCW waveform transmission by the second UE based at least in part on the identifying the correspondence.

20. The apparatus of claim 14, wherein the instructions are further executable by the processor to cause the apparatus to determine waveform shape parameters for the FMCW waveform over the set of chirps based at least in part on the codeword of the codebook.

21. The apparatus of claim 14, wherein the phase code comprises a Zadoff-Chu sequence.

22.—— The apparatus of claim 14, wherein the set of chirps comprises a first number of chirps and a length of the phase code is less than or equal to the first number of chirps.

23.—— The apparatus of claim 14, wherein the instructions to synchronize the UE are further executable by the processor to cause the apparatus to synchronize at least one chirp transmission boundary for the transmitting the FMCW waveform using the phase code with a chirp transmission boundary for a second FMCW waveform transmission by a second UE using a second phase code.

24.——— The apparatus of claim 23, wherein the instructions are further executable by the processor to cause the apparatus to:

derive the common timing using coordinated universal time (UTC); and

add the common timing to the set of chirps, wherein the synchronizing is based at least in part on the adding the common timing.

25.—— The apparatus of claim 14, wherein the instructions are further executable by the processor to cause the apparatus to select the codeword of the codebook based at least in part on phase code information for a second UE, wherein the codeword indicates phase code information for the phase code of the UE different from the phase code information for the second UE.

26.—— The apparatus of claim 25, wherein the instructions to select the codeword are further executable by the processor to cause the apparatus to select the codeword such that a distance between the codeword and a second codeword for the second UE is maximized.

27.——— An apparatus for radar signaling implemented by a user equipment (UE~~),~~) in a wireless communications system, comprising:

means for ~~identifying a set of chirps~~ synchronizing the UE to a common timing associated with the wireless communications system; and means for transmitting a frequency modulated continuous wave (FMCW) waveform~~;~~

~~means for determining~~ using a phase code for a set of chirps of the FMCW waveform based at least in part on the synchronizing, the phase code determined for the set of chirps based at

least in part on a codeword of a codebook~~; and~~, wherein the codeword is associated with the FMCW waveform.

~~means for transmitting the FMCW waveform using the phase code.~~

28.——— The apparatus of claim 27, further comprising:
means for varying waveform shape parameters of the FMCW waveform over a subset of the set of chirps.

29.—— The apparatus of claim 28, wherein the waveform shape parameters comprise a slope ß, a frequency offset f0, or a combination thereof.

30.——— The apparatus of claim 29, wherein the means for varying the waveform shape parameters of the FMCW waveform over the subset of the set of chirps comprise:
means for selecting the slope ß for the subset of the set of chirps such that the slope ß is different from a second slope ß for a second FMCW waveform transmission by a second UE overlapping in time.

31.——— The apparatus of claim 29, wherein the means for varying the waveform shape parameters of the FMCW waveform over the subset of the set of chirps comprise:
means for identifying that the slope ß for the subset of the set of chirps is the same as a second slope ß for a second FMCW waveform transmission by a second UE overlapping in time; and
means for selecting the frequency offset f0 for the subset of the set of chirps such that an interference peak of the second UE appears beyond a range of interest based at least in part on the identifying that the slope ß is the same.

32.——— The apparatus of claim 29, ~~wherein the means for determining the phase code for the set of chirps comprise:~~
further comprising: means for identifying a correspondence between the slope ß and the frequency offset f0 for the subset of the set of chirps and a second slope ß and a second frequency offset f0 for a second FMCW waveform transmission by a second UE, the first and second FMCW waveform transmissions overlapping in time; and

means for determining the phase code such that phase modulation for the subset of the set of chirps is different from a second phase modulation for the second FMCW waveform transmission by the second UE based at least in part on the identifying the correspondence.

33. The apparatus of claim 27, further comprising:
means for determining waveform shape parameters for the FMCW waveform over the set of chirps based at least in part on the codeword of the codebook.

34. The apparatus of claim 27, wherein the phase code comprises a Zadoff-Chu sequence.

35. The apparatus of claim 27, wherein the set of chirps comprises a first number of chirps and a length of the phase code is less than or equal to the first number of chirps.

36. The apparatus of claim 27, ~~further comprising:~~
wherein the means for synchronizing the UE comprise: means for synchronizing at least one chirp transmission boundary for the transmitting the FMCW waveform using the phase code with a chirp transmission boundary for a second FMCW waveform transmission by a second UE using a second phase code.

37. The apparatus of claim 36, further comprising:
means for deriving the common timing using coordinated universal time (UTC); and
means for adding the common timing to the set of chirps, wherein the synchronizing is based at least in part on the adding the common timing.

38. The apparatus of claim 27, further comprising:
means for selecting the codeword of the codebook based at least in part on phase code information for a second UE, wherein the codeword indicates phase code information for the phase code of the UE different from the phase code information for the second UE.

39. The apparatus of claim 38, wherein the means for selecting the codeword comprise:

means for selecting the codeword such that a distance between the codeword and a second codeword for the second UE is maximized.

40. A non-transitory computer-readable medium storing code for radar signaling implemented by a user equipment (UE~~), the code comprising instructions executable by a processor to:~~) in a wireless communications system, the code comprising instructions executable by a processor to: synchronize the UE to a common timing associated with the wireless communications system; and transmit a frequency modulated continuous wave (FMCW) waveform using a phase code for a set of chirps of the FMCW waveform based at least in part on the synchronizing, the phase code determined for the set of chirps based at least in part on a codeword of a codebook, wherein the codeword is associated with the FMCW waveform.

~~identify a set of chirps associated with a frequency modulated continuous wave (FMCW) waveform;~~

~~determine a phase code for the set of chirps based at least in part on a codeword of a codebook; and~~

~~transmit the FMCW waveform using the phase code.~~

41. The non-transitory computer-readable medium of claim 40, wherein the instructions are further executable to: vary waveform shape parameters of the FMCW waveform over a subset of the set of chirps.

~~vary waveform shape parameters of the FMCW waveform over a subset of the set of chirps.~~

42. The non-transitory computer-readable medium of claim 41, wherein the waveform shape parameters comprise a slope ß, a frequency offset f0, or a combination thereof.

43. The non-transitory computer-readable medium of claim 42, wherein the instructions to vary the waveform shape parameters of the FMCW waveform over the subset of the set of chirps are further executable to:

select the slope ß for the subset of the set of chirps such that the slope ß is different from a second slope ß for a second FMCW waveform transmission by a second UE overlapping in time.

44.——— The non-transitory computer-readable medium of claim 42, wherein the instructions to vary the waveform shape parameters of the FMCW waveform over the subset of the set of chirps are further executable to:

identify that the slope ß for the subset of the set of chirps is the same as a second slope ß for a second FMCW waveform transmission by a second UE overlapping in time; and

select the frequency offset f0 for the subset of the set of chirps such that an interference peak of the second UE appears beyond a range of interest based at least in part on the identifying that the slope ß is the same.

45.——— The non-transitory computer-readable medium of claim 42, wherein the instructions ~~to determine the phase code for the set of chirps~~ are further executable to:

identify a correspondence between the slope ß and the frequency offset f0 for the subset of the set of chirps and a second slope ß and a second frequency offset f0 for a second FMCW waveform transmission by a second UE, the first and second FMCW waveform transmissions overlapping in time; and

determine the phase code such that phase modulation for the subset of the set of chirps is different from a second phase modulation for the second FMCW waveform transmission by the second UE based at least in part on the identifying the correspondence.

46.—— The non-transitory computer-readable medium of claim 40, wherein the instructions are further executable to: determine waveform shape parameters for the FMCW waveform over the set of chirps based at least in part on the codeword of the codebook.

~~determine waveform shape parameters for the FMCW waveform over the set of chirps based at least in part on the codeword of the codebook.~~

47.—— The non-transitory computer-readable medium of claim 40, wherein the phase code comprises a Zadoff-Chu sequence.

48.—— The non-transitory computer-readable medium of claim 40, wherein the set of chirps comprises a first number of chirps and a length of the phase code is less than or equal to the first number of chirps.

49.——— The non-transitory computer-readable medium of claim 40, wherein the instructions to synchronize the UE are further executable to:
synchronize at least one chirp transmission boundary for the transmitting the FMCW waveform using the phase code with a chirp transmission boundary for a second FMCW waveform transmission by a second UE using a second phase code.

50.——— The non-transitory computer-readable medium of claim 49, wherein the instructions are further executable to:
derive the common timing using coordinated universal time (UTC); and
add the common timing to the set of chirps, wherein the synchronizing is based at least in part on the adding the common timing.

51.——— The non-transitory computer-readable medium of claim 40, wherein the instructions are further executable to:
select the codeword of the codebook based at least in part on phase code information for a second UE, wherein the codeword indicates phase code information for the phase code of the UE different from the phase code information for the second UE.

52.——— The non-transitory computer-readable medium of claim 51, wherein the instructions to select the codeword are further executable to:
select the codeword such that a distance between the codeword and a second codeword for the second UE is maximized.