Claims

1. A method of detecting ~~cyber-~~cyber-attacks on a cyber physical system which includes at least one computing device communicatively coupled to at least one sensor and/or actuator for controlling a physical process, the method comprises:

(i) deriving invariants~~at least one invariant~~ for the at least one computing device, based on a system design of the cyber physical system or computer code configured to control the cyber physical system in relation to the physical process or data collected from the cyber physical system during testing or operation of the cyber physical system, the invariants defining a set of conditions that enable determination from the at least one sensor and/or actuator regarding process anomalies of the physical process being controlled, the invariants comprising at least one state-dependent invariant that defines a state of the at least one sensor and/or actuator and at least one state-agnostic invariant derived from the cyber-physical system's physics and chemistry properties;

(ii) configuring the invariants as corresponding invariant computer ~~code~~program; and

(iii) executing the invariant ~~as the~~ computer ~~code~~program on the at least one computing device to monitor the physical process via the at least one sensor and/or actuator and detect the process anomalies for detecting the ~~cyber-~~cyber-attacks, wherein step (iii) further includes retrieving measurements from the at least one sensor and/or actuator, and matching the retrieved measurements against the set of conditions defined in the invariants to detect the anomalies in operation of the at least one sensor and/or actuator.

~~2. The method of claim 1, wherein the invariant is a state-dependent invariant.~~

~~3. The method of claim 1, wherein the invariant is a state-agnostic invariant.~~

4~~2~~. The method of ~~any preceding~~ claim~~s~~ 1, wherein the invariants ~~is~~are derived as a mathematical relationship involving inputs and/or output variables of the at least one sensor and/or actuator used in controlling the physical process.

~~5~~3. The method of ~~any preceding~~ claim~~s~~ 1, wherein the at least one computing device includes a plurality of computing devices, each computer device respectively coupled to ~~respective~~ at least one sensor and/or actuator, and wherein step (i) includes deriving respective invariants for each of the ~~respective~~ computing devices.

~~6~~4. The method of claim ~~5~~3, wherein the plurality of computing devices includes being communicatively coupled to a communication network of the cyber physical system.

~~7~~5. The method of ~~any preceding~~ claim~~s~~ 1, wherein the computing device includes a programmable logic controller.

~~8~~6. The method of ~~any preceding~~ claim~~s~~ 1, wherein the cyber physical system is arranged to be part of a water treatment plant, a waste-to-energy plant, a transportation control centre, an oil and gas production plant, or a power grid.

~~9. The method of any preceding claims, wherein step (iii) further includes retrieving measurements from the sensor and/or actuator, and matching the retrieved measurements against the set of conditions defined in the invariant to detect the anomalies in operation of the sensor and/or actuator.~~

~~10~~7. The method of ~~any preceding~~ claim~~s~~ 1, wherein the system design of the cyber physical system is provided in the form of a plurality of state condition graphs or design diagrams.

~~11~~8. The method of claim ~~10~~7, wherein the design diagram is a process and instrumentation diagram or a line diagram.

~~12~~9. The method of ~~any preceding~~ claim~~s~~ 1, wherein the configured computer code of the invariant is programmatically integrated with control code of the computing device.