Two-way driving connection between model and cyber units of CPS robot system

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About the topic

Recent new paradigm of cyber physical system (CPS) changed research and development of multidisciplinary engineering structures. In the context of this topic, phrase engineering structure is applied for multidisciplinary system-based experimental engineering configuration. CPS exists in virtual (complex model) and field operating forms. Its production is done in production system which is the third a CPS in the scenario and is based on the recent paradigm of Industry 4.0. This research topic was defined to establish and improve communication between virtual and field operating forms of CPS robot system.

Aims of research

Research topic includes definition active logical, mathematical, and algorithmic connections between representations in robot model system and cyber units in field operating robot system. Emphasis is on finding connectable active model objects in robot model and relevant cyber unit objects then establishing connection. Other aim is proposal application actual information about physical unit operation at improving robot model representation. Actual information about physical unit operation is collected by sensor network then communicated by cyber units of CPM.

Research task

Study the scenario which includes generic robot model, controller in robot model, configuration of joints for generic robot kinematic classes, recognized cyber units in robot control systems, and information derived from intelligent sensor network. Reveal relevant existing research results and define plan of own research work. Restrict the scenario to selected relevant objects. Study the modeling capabilities in 3DExperience platform for the relevant roles (See: “Laboratory software” below). As new own contribution, define and verify active logical, mathematical and algorithmic connections between representations in robot model system and cyber units in field operating form of robot system in accordance with the own research plan. Develop experimental engineering model which is appropriate for verification the above results using capabilities available in the 3DExperience. Simulate the cyber units involved.

Benefits at application of the awaited research results

Research in this topic is motivated by industrial problem solving related research capabilities available at the 3DExperience platform. In this way, results can be validated in industrially eligible model and they are potentially suitable for industrial problem solving. At the same time, this means joining to the recent trend for integration of theory and practice.

Laboratory software

Modeling capabilities are available for this student research at the Laboratory of Intelligent Engineering Systems in the 3DExperience platform from cloud for the relevant researcher roles below. Basic modeling capabilities are also available for the development of the experimental engineering model in integration with role related capabilities.

> *Mechatronic Systems Designer (SMQ)* provides Modelica and 3DEXPERIENCE related capabilities to develop, simulate and validate complex mechatronic systems.
>
> *Robotics Engineer (RTS)* provides capabilities for simulation and validation robot system behavior.

Robotics in the V6 system provides capabilities for model definition of robot system, robot control, direct and invers kinematics, velocity and acceleration, motion sets, kinematic relations, and realistic robot simulation. Basic modeling capabilities are available in integration.

Literature

Recent actual and time-honored classical publications about relevant research results should be surveyed. The planned research should be placed in former published results of others to prove its novelty.