2nd Workshop on Fail Safety in Medical Cyber-Physical Systems (FS-MCPS)

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Medical cyber-physical systems (MCPSs) extend the notion of conventional medical devices to more complex technical systems in close connection to humans, e.g., acquiring sensor data, controlling a treatment, or monitoring recovery. Typically, these systems include the patient in the loop and require a high degree of dependability and fail safety. One challenge is the complex nature of physiological processes, which are often patient-specific and less deterministic than in, e.g., engineering scenarios. Thus, many of the underlying interactions are today still not modeled in detail. Another challenge is the growing complexity of medical systems and devices themselves. Hence, fail safety of a MCPS cannot be achieved within a single component or layer — neither the software layer nor any other isolated layer —, but requires an interdisciplinary effort addressing different aspects, including patient modeling, hardware, software, and communication.

The workshop covers these aspects and discusses software-engineering issues of MCPS. Intended as a platform for interdisciplinary exchange the topics range from theoretical foundation of fail safety to actual applications of MCPS. Interoperability and integration of different devices has been an active research field, particularly as computer assistance for decision support and guidance of interventional procedures requires an aggregation of data provided by different systems. The design of interfaces and emerging standards for interoperability must consider the safe operation of the overall system. This includes meeting temporal constraints, e.g., when illustrating organ movements during image guidance or for automated motion compensation. Moreover, consistent, fail safe, and secure data exchange on the hardware and software level are essential for connecting devices, particularly when longer distances are covered, e.g., for remote and ambient assistance scenarios. The latter also require reliable network protocols and resource management. Architectures and algorithms for the interaction in a MCPS, which are capable of tolerating latency and package loss due to unstable connections, are desired. Furthermore, the implications of change at one point in a system to the connected remainder is addressed.

Clearly, the move towards more complex systems in clinical practice is gradual and requires compliance with existing regulations and integration with existing devices. Bringing together researchers and practitioners in the field of MPCS we summarize the state of the art and discuss obstacles and challenges on the way to fail-safe MCPS. We are grateful for the keynote talk by Wolfgang Reisig (Humboldt Universität zu Berlin) and the two tutorials on Polyspace and Uppaal by Christian Guss and Jakob Taankvist, who

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