

Future Resilient Systems

Resilient Infrastructure Systems for Uncertain Environments

The Future Resilient Systems programme develops a framework, concepts, and tools to make interconnected infrastructure systems more robust and resilient.

Infrastructure as the 'Backbone' of Society

The modern society of today is highly dependent on the network of infrastructure systems that provide essential services to its inhabitants, including energy, transport, communication, financial, production, and other services that support day-to-day activities.

Today, a growing range of hazards threatens infrastructure systems, including natural, technological, social, cyber, and political threats. Social and behavioural factors contribute to new patterns of disruptive behaviour. Moreover, with increasing interconnectivity of infrastructure systems, disruptions such as floods, power outage, and cyber attacks can spark off a chain of cascading system failures. In recent times, system failures that have grounded flights, crippled public transport systems and frozen stock exchanges have proven to be costly.

To address the challenges of increasingly interconnected and complex infrastructure systems, the Future Resilient Systems was established in 2014 as the second programme of the Singapore-ETH Centre.

Paradigm Shift Towards Resilient Systems

The Future Resilient Systems programme explores ways to make infrastructure systems more resilient, enabling them to absorb shock, recover, self-organise, learn, and eventually self-modify, much like a biological system. This paradigm change from system resistance to system resilience is a promising framework to cope with uncertain future shocks of unexpected magnitudes.

FRS contributes to a paradigm shift by

- 1 Improving our understanding of the interdependencies of critical infrastructure systems
- 2 Developing a simulation platform to assess the interaction of complex engineered systems
- 3 Providing tools and indicators to assess the resilience of energy systems
- 4 Improving our understanding of the role of human factors in system robustness and resilience

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Researchers

Approaching the study of infrastructure systems from a socio-technical perspective, the Future Resilient Systems taps on the expertise of over 60 researchers across the fields of engineering, natural and social sciences. The programme provides a cross-disciplinary and cross-cultural environment, bringing together Principal Investigators, PhD students and postdoctoral fellows from Switzerland-based ETH Zurich and Paul Scherrer Institute; and Singapore-based Nanyang Technological University, National University of Singapore, and Singapore Management University.

Based in Singapore, researchers at the FRS also works closely with Singaporean government agencies including the Defence Science and Technology Agency, DSO National Laboratories, the Energy Market Authority, the National Environment Agency, and the National Security Coordination Secretariat.



Project Leader

Prof. Dr Hans Rudolf Heinimann is Professor of Forest Engineering at ETH Zurich and founding member of the ETH Risk Centre, where he served as Chairman from 2011 to 2013. Prof. Heinimann was Prorector for Education at ETH Zurich from 2007 to 2013, among his various positions held in university bodies, including the Head of Department, Director of studies, and Head of institute.

The Singapore-ETH Centre

Future Resilient Systems is the second programme of the Singapore-ETH Centre for global environmental sustainability, established by ETH Zurich – the Swiss Federal Institute of Technology in Zurich and Singapore's National Research Foundation (NRF), as part of the NRF's Campus for Research Excellence and Technological Enterprise (CREATE).

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