4TU.DeSIRE

Designing Systems for Informed Resilience Engineering

TU Delft Delft University of Technology

TU/e Technische Universiteit Eindhoven University of Technology

UNIVERSITY OF TWENTE.

WAGENINGEN UNIVERSITY & RESEARCH

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Designing Systems for Informed Resilience Engineering

‘Designing Systems for Informed Resilience Engineering’ (DeSIRE) is an extensive interdisciplinary research programme that shapes the 4TU Centre for Resilience Engineering (4TU.RE) and builds its capacity.

Programme leader prof.dr. Tatiana Filatova: "Our goal is to build a thriving community on resilience of complex social-technical-environmental systems. DeSIRE creates multidisciplinary capacity across the 4TUs with applications across sectors: agri/food, energy/cyber, transportation networks/supply chain, urban, water and a cross-sectoral working group on decision-making for resilience." Read more online:

Water

4TU.DeSIRE Working Group

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The Resilience Water working group aims to tackle some of the new arising climate change challenges for water systems derived from environmental shocks and stresses, such as the climate-induced increase in duration and frequency of extreme droughts, sea level rise and floods. It has been already observed that the actual water supply and flood defence systems will eventually require more holistic solutions in terms of absorption, adaptation and recovery, as most of the previously implemented solutions were developed as isolated measures, disregarding the possible impacts in other areas of urban, rural and socio-economic development. It is also clear that the feedback between these shocks and socio-economic and governance systems need to be considered.

Transportation networks / supply chain

4TU.DeSIRE Working Group

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The focus of the Transportation networks / supply chain working group is to study the robustness and resilience of supply chains as well as transportation networks. In the past years, we have seen that disruptions, such as the COVID19 pandemic and Suez Canal blockage, had enormous negative financial and societal impacts. We have also seen analysis on how the disruption on one side of the network can propagate in the whole network.

In this working group, we investigate how we can use different available techniques or develop new ones to assess the robustness and resilience of networks, and (re)design a more robust and resilient supply chain and transportation network.

Energy / Cyber

4TU.DeSIRE Working Group

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The goal of the Energy / Cyber working group is to assess and improve the cyber security and resilience to cyber-attacks and natural disasters of integrated cyber-physical energy systems. This research sets the mathematical and computational foundations and develops technologies that advance the field of resiliency and cyber security to protect interconnected power grids against major disturbances in a highly connected environment. It considers future developments in transmission and distribution systems, digitalization and cyber security threats.

The objectives are to develop cyber-physical system models, computational methods and artificial intelligence-based tools to enhance the resilience of power grids to high-impact, low-frequency disturbances.

Decision making for resilience

4TU.DeSIRE Working Group

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The working group on decision making under uncertainty for enhancing resilience focuses on understanding decision making processes and the use of decision support methods as well as on developing governance arrangements and decision-support methods that enable public and private sector actors to make decisions that enhance societal resilience.

This working group is not domain specific and includes experts from the fields of water, agriculture, the urban environment, infrastructure, supply chain, and energy. The working group’s main aim is to discuss work in progress, both from the scientific field as well as from practitioners sharing specific cases, implemented methodologies and approaches, and innovations. Key concepts this working group works with are: uncertainty, decision making, adaptation, transformation, institutions, governance, modelling.

Designing Systems for Informed Resilience Engineering

"I am proud to be part of this very special network. DeSIRE is one of the rare effective initiatives on Resilience. It personally provided me with opportunities to get visible and eventually secure a position I always wanted." An associated DeSIRE Tenure tracker

Agri / Food

4TU.DeSIRE Working Group

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The working group on resilience for agri-food systems works on several Sustainable Development Goals and EU societal challenges, such as an affordable and sustainable food production for 9 Billion people by 2050, and the transition of the Dutch agri-food sector to a sustainable, circular system. Major questions we work on are:

- How can the food sector(s) in the EU make a transition, and what should it transition into? How would a change of the food sector(s) in the EU affect other food production systems, e.g., in the Global South?
- Can the resilience of food supply systems against climate change, shocks like the COVID-19 pandemic, be improved without a loss of efficiency, e.g., through social capital?
- How to quantify risks for different stakeholders, like farmers, banks, companies, and sectors, and what are ways of improving their resilience?

Urban

4TU.DeSIRE Working Group

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The working group on Urban Resilience is an interdisciplinary group of researchers committed to creating impact for resilience in urban areas through the design of physical systems as well as of multi-actor or participatory processes. The group covers a wide range of concerns related to endowing urban areas with the capacity to cope with the challenges of climate change, urban transformation, environmental quality, spatial quality, build governance and institutions, identity, equality/justice, and urban-rural spatial relationships in an integrated way. The group aims at deepening knowledge on urban resilience through theorizing, measuring and designing. We use a social-technical-environmental (STE) systems approach, linking the physical/spatial and socio-economic dimensions of the built environment and creating impact through the reshaping of urban areas and relations towards resilience.

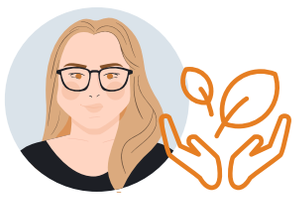
Collaboration and DeSIRE Fellows

50+ active, international Resilience Fellows and 13 Strategic Ambassadors

Resilience Engineering Academy: 100+ Open Educational Resources

Collaborations with:
- academia
- engineers
- practitioners
- decision-makers

In 2021 we collaborated in 14+ subsidized projects



Solution Teams working with municipalities and Security Regions in Utrecht and The Hague, Zwolle, Amsterdam and Rotterdam

Ambition and mission
The ambition of DeSIRE and the 4TU.RE community is to create a solid scientific and engineering knowledge base about the resilience of coupled social-technical-environmental systems and to translate this knowledge into educational programs, policies, designs and solutions that benefit society.

DeSIRE researchers are committed to linking different domains and disciplines within and beyond academia and building a transdisciplinary community around Resilience Engineering.

Towards this goal DeSIRE creates multidisciplinary capacity across the 4TUs with applications across sectors: agri/food, decision making for resilience, energy/cyber, transportation networks/supply chain, urban and water.

Accomplishments
Our accomplishments in realizing this mission are among others collaborations with ASML, contributing to the MX3D bridge project in Amsterdam, developing a Resilience Game and contributing to the Control Room of the Future (Delft) and international collaborations with Texas A&M, Turku University Finland, and many others. Read more about our accomplishments in our 4TU.Resilience Engineering centre flyer.

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4TU.DESIRE
IMPACT IN 2021

HIGH TECH FOR A SUSTAINABLE FUTURE

17 17 Tenure Trackers

20 20 Postdocs

50 over 50 Resilience Fellows

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