

# Preface

This book collects the tutorial material developed by the authors during the six editions of the Master Classes and Courses on Modelling, Simulation and Analysis of Critical Infrastructures. These training events attracted more than 200 students from all over Europe and represented the cornerstone instrument for the training program developed inside the Critical Infrastructure Preparedness and Resilience Research Network (CIPRNet) project.

CIPRNet is a Network of Excellence in the field of Critical Infrastructure Protection (CIP) composed of twelve outstanding institutions on the different topics involved in the CIP domain and co-funded by the European Union under the Seventh Framework Programme (FP7) for research, technological development and demonstration.

CIPRNet moves from the fact that our societies are increasingly dependent on the correct functioning of a huge number of technological infrastructures. Several of these infrastructures are so relevant for our wellness that they are generically indicated as a Critical Infrastructure (CI). In the last two decades for political, technological, economical and societal reasons which includes the following:

- unbundling power generation, transmission and distribution in the electrical power sector,
- globalization of the markets,
- diffusion of ICT and mobile telecommunication systems,
- introduction of “smart” paradigms (e.g. smart grids and smart cities) and
- increasing use of Internet.

We observed a significant change in these infrastructures that evolved from monopolistic and monolithic systems to open market configurations. This paradigm shift allows providing to end-user more effective, efficient, user-centric and user-friendly services with a significant reduction in costs. However, this exposes the CIs to a large number of potential dangerous threats. This happens because the actual socio-technical scenario is characterized by a large increase in (reciprocal) dependencies among the different infrastructures. This phenomenon severely contributes to increasing the complexity of the whole scenario, which, if more robust

to high-frequency low-impact events, appears more and more prone to systemic and catastrophic failure as dramatically emphasized by the pan-European and pan-America electric blackouts of 2003.

In this framework, there is also the need of increasing the capabilities of CIs to be protected against malicious enemies starting from terrorist and cyber threats. To prevent, contrast and mitigate the effect of all-hazard, CI stakeholders, CI operators and civil protection authorities need to understand the complex system of CIs and need to adapt to these changes and threats in order to be as prepared as possible to mitigate emergencies and crises affecting or emerging from CIs.

Although significant research on CI systems and on their improvement, protection and resilience has been performed in Europe in the last 15 years, the transfer of research results into practical applications lags behind expectations. One of the model examples for successful transfer of research results on Critical Infrastructure Protection into application is the facility NISAC, the National Infrastructures Simulation and Analysis Centre. It supports preparedness and protection of the nation and society by analyzing CI loss or disruption. This may also be performed in the hot phase of an emergency or crisis and enable operators to take protection, reaction, mitigation and reconstruction decisions. NISAC provides advanced capabilities based on modelling, simulation and analysis (MS&A) to CI operators, civil protection agencies and other stakeholders. It has the capacities to develop, improve and deploy these capabilities contributing to an enhanced national preparedness. Such a facility and the capabilities and capacities that NISAC provides are lacking in Europe.

CIPRNet plans to make a first step in order to change that by creating new capabilities for CI operators and emergency managers and building the required capacities for developing and deploying these capabilities. CIPRNet is linking the currently scattered European CIP research entities into an integrated virtual community with the capability of supporting national, cross-border and regional emergency management and Member States for a more effective response to large national and cross-border disaster emergencies while taking CIs into account.

Towards this end, CIPRNet integrates resources of the CIPRNet partners acquired in more than 60 EU co-funded research projects, to create new and advanced capabilities for its stakeholders with a long-lasting vision to set up a virtual centre of shared and integrated knowledge and expertise in CIP. This virtual centre shall provide durable support from research to end-users. It will be the foundation for the European Infrastructures Simulation and Analysis Centre (EISAC).

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