

Earthquake Damage and Loss Assessment for Oil and Gas Systems

Erdal Safak^{1*}, Ufuk Hancilar¹, Eser Caktı¹, Karin Sesetyan¹, Goktekin Durusoy² and Yaver Kamer³

¹Bogazici University, Kandilli Observatory and Earthquake Research Institute, Department of Earthquake Engineering, Turkey

²Bogazici University, Department of Electrical & Electronics Engineering, Turkey

³ETH, Department of Earth Sciences, Switzerland

System level damage assessment for critical infrastructure and lifelines is vital for their efficient management before, during and after earthquakes. ELER-Lifelines (Earthquake Loss Estimation Routine-Lifelines) has been developed for the assessment of earthquake risks associated with four critical lifeline networks: Oil, Gas, Water and Electric transmission and distribution systems. It is a standalone application with a modular structure that is coded in Matlab. As input to damage analyses, spatial distributions of earthquake ground motion parameters, e.g. peak ground acceleration, velocity, etc., are computed with the ground-shaking module. It is also possible to incorporate recorded real- or near-real time ground motion data, if available, in the production of ground shaking maps. Risk analyses are realized at network and component levels for each lifeline system by separate loss modules. For this purpose geographical and earthquake risk related attributes of system elements are required. Expected damages and losses are calculated with alternative fragility/vulnerability models and the resulting damage distribution maps are presented. For gas and oil networks, the following system elements are considered in the software: refineries, processing plants, pumping stations, tank farms and pipelines. The software is currently being used in the Abu Dhabi Emirate. The gas, water and power modules of the software are being integrated to the Istanbul Earthquake Rapid Response System, which was originally developed for the estimation of building damages in Istanbul during strong earthquakes.

Biography:

Professor Erdal Safak has a Ph.D. in Structural Engineering from the University of Illinois at Urbana-Champaign. He was a researcher with the U.S. Geological Survey for 22 years, specializing on ground motion modeling, structural instrumentation, and data analysis. He thought classes at Colorado School of Mines in Golden, Colorado and The George Washington University in Washington, DC. In August 2006, he joined to the Kandilli Observatory and Earthquake Research Institute of Bogazici University in Istanbul, Turkey, and was the Head of the Earthquake Engineering Department until July 2018. He has over two hundred publications on subjects related to earthquake engineering.