Bauhaus-Universität Weimar

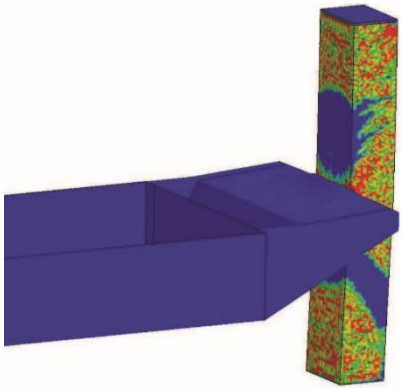
Institute of Structural Engineering
Chair of Modelling and Simulation of Structures
Prof. Dr. Guido Morgenthal

Probabilistic Quantification of Residual Load-Bearing Capacity of Infrastructure Buildings under Extreme Loading Scenarios

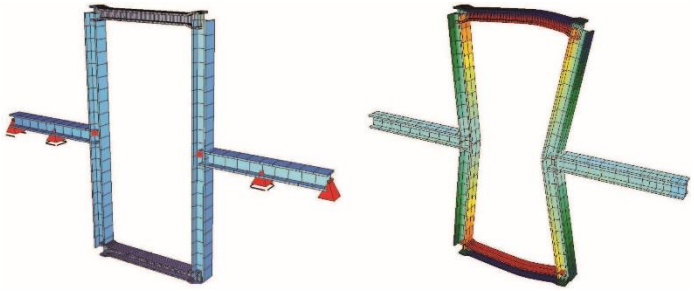
Abstract

Ship impact and earthquake are two types of extreme loading which threaten the safety of bridges and RC frame buildings. Non-linear numerical modeling and simulation is used to predict the dynamic responses and damage of structures under such extreme loading scenarios. Complex mechanical behaviors involving physical and geometric non-linearity and strain rate effects on material properties are considered in the numerical models. The research interests are listed as follows:

- Non-linear dynamic response analysis of structures under extreme loading scenarios based on finite element method.
- Development of computationally efficient simplified models with sufficient prediction accuracy based on certain structural idealizations to replicate the complex numerical models.
- Prediction of residual load-bearing capacity of structurally deficient infrastructure buildings after ship impact or seismic loading scenarios based on the concept of limit analysis and shakedown analysis.
- Uncertainty probabilistic analysis, e.g. sensitivity analysis, reliability analysis which considers the stochastic properties of material, structural geometry, loading, etc.
- Development of novel energy-dissipation crashworthy devices to reduce the damage of structures subjected to extreme loading scenarios, e.g. ship impact



Ship impact with RC pier column



A novel steel frame crashworthy device for pier protection from ship impact

Contact person

Wei Wang
Tel.: +49 3643 584442
E-Mail: wei.wang@uni-weimar.de

Related publications

1. Wang, W., Morgenthal, G., Dynamic analyses of square RC pier column subjected to barge impact using efficient models, Engineering Strucutures, 151 (2017), pp. 20–32
2. Wang, W., Morgenthal, G., Novel Crashworthy Device for Pier Protection from Barge Impact, Advances in Civil Engineering, Vol. 2018 (2018)
3. Wang, W., Morgenthal G., Reliability analyses of RC bridge piers subjected to barge impact using efficient models, Engineering Structures, 166 (2018), pp. 485–495
4. Wang, W., Morgenthal, G., Development and assessment of efficient models for barge impact processes based on nonlinear dynamic finite element analyses, Engineering Strucutures, 175 (2018), pp. 617–627
5. Wang, W., Morgenthal, G., Parametric Studies of Pile-Supported Protective Structures Subjected to Barge Impact Using Simplified Models, Marine Structures, 63 (2019), pp. 138–152
6. Morgenthal, G., Wang, W., Kraus, M., Numerische Untersuchungen einer energiedissipierenden Schutzvorrichtung gegen Schiffsanprall, Stahlbau, 88(4) (2019), pp. 314–323