

## ADAPTIVE STRUCTURES SUBJECTED TO IMPACT LOADS

MOHAMMAD S. MIAH<sup>†,1</sup>, MICHAEL MALISKE<sup>†,2</sup>

<sup>†,1</sup>TU Dresden's Institutional Strategy, Institute for Structural Analysis (ISD), Faculty of Civil Engineering, Dresden University of Technology- TU Dresden, 01187 Dresden, Germany  
Mohammad-Shamim.Miah@tu-dresden.de, [https://tu-dresden.de/bu/bauingenieurwesen/sdt/institut\\_xy](https://tu-dresden.de/bu/bauingenieurwesen/sdt/institut_xy)

<sup>†,2</sup>Institute for Structural Analysis (ISD), Faculty of Civil Engineering, Dresden University of Technology- TU Dresden, 01187 Dresden, Germany  
michael.kaliske@tu-dresden.de, [https://tu-dresden.de/bu/bauingenieurwesen/sdt/institut\\_xy](https://tu-dresden.de/bu/bauingenieurwesen/sdt/institut_xy)

**Key words:** Dynamical Response; Viscous Damping with Negative Stiffness, Impact Loads, Adaptive Structures, Unscented Kalman Filter.

### ABSTRACT

The structures are not only suffered by static loads such as dead loads, self-weight but also extreme dynamic loads for instance seismic excitation or impact load. It is quite common that unpleasant disturbance is provoked due to the extreme dynamic loads. And such severe vibration needs to be reduced and control in order to keep the structures in safe condition. Typically, to deal with aforementioned problem most of the modern structures are equipped with complex mitigation systems. And those systems required measured information to control and monitor the structure in real-time. However, often all of the degree of freedoms information are not measurable due to efficacy or to avoid complex data management/monitoring systems. In order to monitor the aforementioned system an observer is necessary such as Kalman filter for prediction of unobserved information. Therefore, herein a nonlinear observer namely the unscented Kalman filter (UKF) is adopted as the additive system forms a nonlinear problem. For estimating the control force, a control algorithm known as the viscous damping with negative stiffness (VDNS) is used. To do this end, the performance of a 6-storied frame is evaluated numerically and it is observed that a significant reduction of vibration is possible via the investigated additive approach.