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IDENTIFICATION AND MODEL OF CIVIL STRUCTURE IN DYNAMICS

***Peter Rosko[1]**

[1] Vienna University of Technology
Center of Mechanics and Structural Dynamics
Karlsplatz 13/E2063
A-1040 Vienna
Austria Europe
pr@allmech.tuwien.ac.at

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ABSTRACT

Modeling of civil structures subjected to ground motions is necessary in earthquake resistant analysis and design. Advantageous are simple models with low number of degrees of freedom. Parameters of designed model have to fit the real behaviour of real structure during earthquake. The identification process uses recorded data during earthquake excitation in the basement of the real civil structure. The dynamic response data of the structure are obtained from measurement and from numerical analysis.

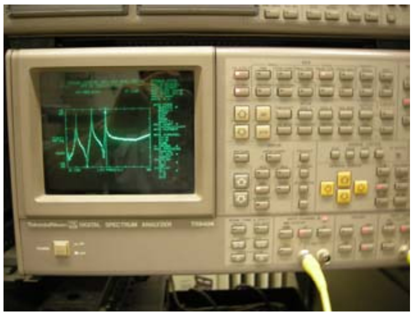
The creation of the model in respect to experimental results is done in three steps.

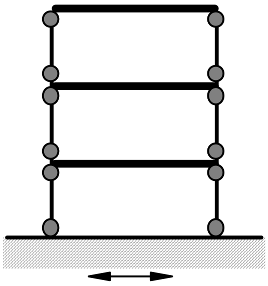
In the first step the response in time and frequency domain is analyzed. The number of degrees of freedom is defined. The analyzed response determines the type of the model – in our study elastic eventually elastoplastic.

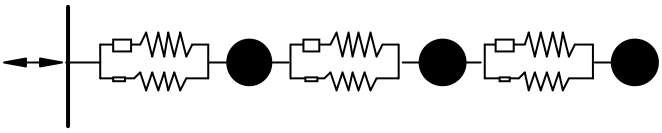
In the second step the model with minimum degrees of freedom is created. Parameters of the model are mass, damping, stiffness or parameters of nonlinearity (force-displacement relation).

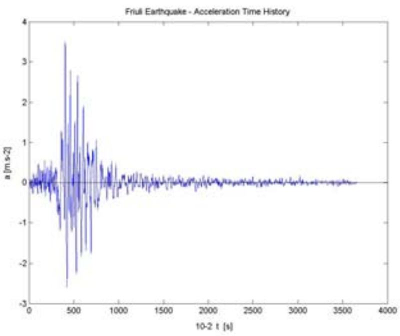
In the third step the parameters of the model are calculated. The time history analysis uses the Chopra`s recurrent formulas with included nonlinearities. The parameter identification is solved as an inverse problem. The inverse problem is defined as an optimization problem. The objective is the error index minimization between data obtained from measurement and results obtained from numerical model. Optimization process uses hybrid genetic algorithm. Parameters of the model are genes in chromosomes. The sensitivity analysis is built in genetic algorithm.

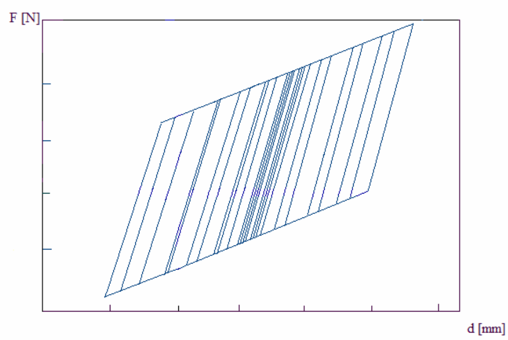
The threestorey elastoplastic frame example is presented. Accelerogram from the Friuli earthquake is applied. The three degrees of freedom system is analyzed. Elastoplastic behavior of aluminium columns is modeled with bilinear hysteresis. Figures show the structure, model, excitation and response.











Conclusion

The presented methodology allows creation of usable linear and nonlinear models of structures in dynamics. The features of these models are low number of degrees of freedom and physically good interpretable system parameters. Derived models are usable for analysis and structural upgrade design.

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