Estimation of glass plate boundary conditions using laser Doppler vibrometer

Marina Plovanić[1,*], Ivica Kožar[1]

[1]*University of Rijeka Faculty of Civil Engineering*
E-mail: marina.plovanic@gradri.uniri.hr, ivica.kozar@gradri.uniri.hr

Abstract

Some material properties can be measured directly but most can only be estimated indirectly. Structural parameters can almost always be estimated indirectly. Estimating parameters and properties from measurements is becoming increasingly important.
Due to the mounting technique with an elastic resin, the boundary conditions of a glass plate are between simply supported and clamped. However, comparing the results of computer models and experiments requires fairly accurate knowledge of the extent to which the supports are clamped. We want to present a method for estimating the boundary conditions of a glass plate based on measurements of vibration velocity at some points on the plate.
Unknown boundary conditions are parameterized with the parameter ‘k’ which describes the extent of the constraint on the supports and has a value in the interval from 0 to 1. The parameter ‘k’ is visible only after the boundary conditions are introduced using Lagrange multipliers. The procedure is similar to [1], [2] and [3], but at this stage of development only experimental and calculated vibration results are compared.
We propose to estimate the constraint on thin plates using experimental measurements and numerical simulations. The unknown extent of the constraint on the supports is determined from different types of data sets, such as displacements, velocities, and accelerations at different sampling frequencies. The extraction of the unknown parameter 'k' is done using inverse analysis techniques.

Keywords

Parameter estimation, boundary conditions, laser Doppler vibrometer, glass plate

References

[1] Kožar, I., Torić Malić, N., Spectral method in realistic modelling of bridges under moving vehicles. *Engineering Structures*, 50, 149-157, 2013.

[2] Kožar, I., Torić Malić, N., Rukavina, T., Inverse model for pullout determination of steel fibers. *Coupled Systems Mechanics*, 7, 197-209, 2018.

[3] Kožar, I., Relating structure and model. In: Ibrahimbegović, A., ed., *Computational Methods for Solids and Fluids*, 161-183. Springer, Heidelberg, 2016.

* Corresponding author