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Natutral oscillations of rectangular plates with holes: using Reissner's approach

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Abstract: The problem regarding the influence of holes on natural oscillations of rectangular plates has not been completely solved yet. Analytical solutions based on the traditional Rayleigh-Ritz and Bubnov-Galerkin approaches are associated with difficulties due to the approximate choice of the approximating functions for the plate deflections which should satisfy the boundary conditions. In this work, in order to study the influence of an arbitrary hole on the frequencies of a rectangular plate with an arbitrary hole, Reissner's variational principle is employed. In order to validate the proposed algorithm, a test problem is solved aimed defining the fundamental frequency of the continuous simply supported square plate. The proposed algorithm of the estimation of fundamental frequency of vibrations of the rectangular plates with a free hole possesses numerous advantages in comparison to the methods used in earlier published works. Namely, it does not introduce any limits on the dimension form and location of the hole and can be extended to study a few holes and other boundary conditions for both the plate and the hole. However, the obtained frequencies can be either larger or smaller than the exact values, and there is no any way to estimate the sign of this deviation.

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