ENERGETIC APPROACH TO STABILITY OF BEAM/COLUMNS SUBJECTED TO DEFORMATION DEPENDENT LOADING

Sz. Imiełowski
Institute of Fundamental Technological Research, Warsaw, Poland

The papers presents an original approach to stability of prismatic beam/columns subjected to potential loading. In that number the force of constant direction, Euler load, as well as generalized follower force, which direction depends on actual deformation of the point of the force application are considered. The beam-column is modeled as elastic one with possible compressing deformation.. The stability analysis is applied by means of static and kinetic approach.

The static energy approach, reveals that transition from straight shape to the bend one depends directly on the energy of the system. This occurs at the point for which the bending energy is lower than energy of compressing, and it appears at the value of loading much lower than critical force. For higher values of loading the compressing proceeds with the stable bend shape until the critical state, which occurs with the stable bend shape too. The critical state is defined by the potential energy of elastic deformation which is equal to the maximum value at this point.

The analysis of kinetic approach reveals that depending on the value of loading the mode of vibration can change from the first to second one and inversely. The phenomenon of the change of the vibration mode is connected with the energy flow from the higher modes to the fundamental mode. Finally the column loss stability by divergence. Also in this case the critical state is defined by energy of the system. Moreover it is observed that, for selected set of parameters, the increase of loading can cause an increase of eigenfrequencies as in flutter systems. Such structure is called divergent pseudo-flutter systems.

The research has been supported by the MNiSzW, Poland, under the Grant nr2765/T02/2006/31

References

1. Sz. Imiełowski, Modal forms of columns subjected to generalized follower force, In: *"Theoretical Foundation of Civil Engineering, X Ukrainian-Polish Transaction"*, W.Szcześniak Ed., (2002), v.10, 141-150,.
2. J.Odorowicz, Analysis of critical and supercritical state of compressed prismatic beam-columns of large slenderness, *Drogi i Mosty*, 59-110, 2/2003,
3. Sz. Imiełowski, R.Bogacz, W.Kurnik, Fixed point in frequency domain of structures subject to generalized follower force, (2001), *Machine Dynamics Problems*, 2001, v.25, 169-182