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A TRANSIENT DYNAMIC PROCESS IN A STRUCTURALLY NONLINEAR SYSTEM "BEAM-ELASTIC FOUNDATION"

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The authors constructed a mathematical model of a transient dynamic process in a loaded beam on an elastic foundation, initiated by the sudden formation of a defect in the form of a change in the boundary conditions: the clamped beam at the ends was transformed into a console.

Before the formation of the defect, the design response was determined by the static action of the external distributed load and by the reaction of the foundation. The sudden formation of a defect leads to a reduction in the overall rigidity of the structure, which no longer ensures the static equilibrium of the system. The inertial forces that have arisen cause a dynamic reaction, redistribution and growth of strains and stresses. As a result, there may be a violation of the regular functioning of the structure, or loss of load capacity and destruction.

The manifestations of the structural nonlinearity and its consequences, that is, changes in the design scheme of the loaded structure during working, as applied to the beam-foundation interaction problems have not yet been adequately studied. There are only a few works by the authors [1-2], in which sudden partial or fully destruction of the foundation was considered.

The forced vibrations of the "damaged" beam were investigated by decomposing the load, the static deflection of the "undamaged" beam and the desired dynamic deflection into series by the modes of free vibrations of the "damaged" beam. Various combinations of the rigidities of the beams and the foundations were considered. Calculations show that the sensitivity of the system to these damages decreases as the generalized rigidity of the "beam-foundation" system increases.

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