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Bifurcational problems about divergence of strip-plate and rectangular plate in supersonic gas blow

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ABSTRACT

The problem about the deflection of a thin flexible strip-plate, which is flowed around by supersonic gas flow along Ox-axis and compressed (expanded) along the edges $x = 0$, $x = 1$ by external boundary stresses is discribed by two-point nonlinear boundary eigenvalue problem for ordinary differential equation of the fourth order with two spectral dimensionless parameters T (characterising the external boundary forces) and σ (proportional to Mach number). By the Sturm method we separate the roots of algebraic equation corresponding to the linearized equation. This allows to change the bifurcational parameters on the new more comfortable ones and define the corresponding eigenvalues and eigenfunctions for direct and conjugate problems. Then the asymptotical Lyapounov-Schmidt method allows to determine the asymptotics of bifurcating solutions in a neighborhood of spectral parameters critical values. We investigate here four various fastenings of the edges (in one of them bifurcation (divergence) is absent).

We investigate also technically more difficult problem about the divergence of rectangular plate flowed around along Ox-axis by supersonic gas flow (without stressed edges), which is describing by von Karman's system with Mach number as bifurcational parameter. The cases of hinged fastening of the edges $y = 0$, $y = b$ and previous four fastenings of edges $x = 0$, $x = 1$ are considered. Here again after separation of variables in the linearized problem the application of the Sturm method allows to introduce new bifurcational parameters and calculate the eigenfunctions of the direct and conjugate problems. The most difficult problem here is the computation of bifurcation equation coefficients.

As result we give the asymptotics of bifurcating solutions. For the hinged fastenings of the edges $x = 0$ and $x = 1$ the divergence again is absent and flutter phenomenon arises.

Keywords: *aeroelasticity, divergence, von Karman's system, bifurcation.*

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