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Global instabilities of the flow over a backward-facing step DANIEL LANZERSTORFER, HENDRIK C. KUHLMANN — The three-dimensional linear stability of the two-dimensional, incompressible flow over a backward-facing step is considered. The geometry is varied covering an expansion ratio from 0.091 to 0.975. The basic flow becomes unstable to three different three-dimensional modes depending on the expansion ratio. An energy-transfer analysis is used to understand the nature of the instability. In the limit of vanishing step height the critical mode is stationary and the amplification process is caused by a Kelvin-Helmholtz-type instability. For high expansion ratios the basic flow features a wall-jet structure and becomes unstable due to centrifugal forces with respect to an oscillatory mode. For intermediate expansion ratios an elliptic instability mechanism is identified and the instability characteristics change continuously with the expansion ratio.

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