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A numerical investigation of the influence of aspect ratio in three dimensional separated flows NIKOLAOS MALAMATARIS, George Mason University/TEI of W.Macedonia — The influence of aspect ratio in three dimensional separated flows is investigated numerically by solving the full three dimensional Navier Stokes equations for Newtonian fluids using standard Galerkin finite elements. As a prototype flow, the backward facing step is chosen with an expansion ratio of 1:2. The Reynolds number is of the order of 1000 where steady state, laminar flow conditions prevail. The computational domain is designed as an actual laboratory experiment with lateral walls and aspect ratios from 1:10 up to 1:40. The results focus on the spanwise variation of the length and the strength of both eddies for this flow that appear along the bottom and top wall. Depending on what attributes of the flow are taken for comparison, aspect ratios of 1:20 up to 1:40 are considered adequate for calling two dimensional flow conditions along the plane of symmetry. The results are contrary to the common wisdom in this field where the aspect ratio of 1:10 is still considered satisfactory two dimensional flow conditions. This is the first computational study for separated flows that raises the issue of two dimensionality along the plane of symmetry and computes the eddy along the top wall for aspect ratios less than 1:35.

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