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STRUCTURE PARAMETERS IN ROTATING COUETTE-POISEUILLE CHANNEL FLOW

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1. Introduction. It is well-known that a number of steady state problems in fluid mechanics involving systems of nonlinear partial differential equations can be reduced to the problem of solving a single operator equation of the form

$$(1.1) \qquad v + \lambda A v + \lambda B(v) = 0, \quad v \in H, \lambda \in \mathbf{R}^1,$$

where H is an appropriate (real or complex) Hilbert space. Here λ is a typical "load" parameter, e.g., the Reynolds number A is a linear operator and B is a quadratic operator generated by a bilinear form. In this setting many bifurcation and stability results for problems in fluid mechanics have been obtained, the reader is referred to [**1, 10, 11, 21**] and the bibliographies therein for a detailed account of such results.

In fact, there may be considerably more structure in a nonlinear stability problem in fluid mechanics than that implied by an operator equation such as (1.1). As shown in a recent series of papers by the authors [**12, 13, 19**], a "structure" parameter, say γ, also may be present so that equation (1.1) may be actually of the form

$$(*) \quad u - \lambda(L - \gamma M)u - F(u) - \gamma G(u) = 0, \quad u \in H, \lambda \in \mathbf{R}^1, \gamma \in \mathbf{R}^1,$$

where H is again an appropriate Hilbert space, L and M are linear operators, and F and G are generated by bilinear operators. Equations of the form (*) are derived in [**12, 13**] for Bénard-type convection problems and in [**19**] for the Taylor problem. It is the purpose of the present paper to describe a setting in which it is possible to determine a complete set of bifurcation equations for an operator equation of the form (*) by using the structure parameter γ as an "amplitude" parameter rather than regarding γ as merely a constant to be incorporated into the

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