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Complex eigenflow in a 3 -D flow systems

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The properties of flow associated with imaginary eigenvectors has been extensively studied and is well understood in 2-D deformation systems in rocks. It has been demonstrated (Ramberg, 1975) that for very high vorticity numbers (Wn $>$ 1) the flow field is completely controlled by imaginary eigenvalues. In such a context, the eigenvectors of the flow do not behave as attractors or repulsors and, depending on the eigenvalues, there will be circular or elliptical flow lines resulting in pulsating strain and giving rise to a non – stable rock fabric (McKenzie, D. 1979; Weijermars, R., 1993). By analogy with eigenvectors we call the lines of minimum velocity in such flow patterns "ghost eigenvectors". Using analytical consideration, we calculated all possible ghost eigenvectors that can develop within a 3-D homogeneous and steady state flow system.

This includes the following aspects:

1. we classify the possible eigenvalue distribution and discuss the nature of some associated flow patterns predicting stable flow pattern with complex eigenvalues.

2. we demonstrate that in a 3-D flow system, unlike in the 2-D system, not all three eigenvalues cannot can be imaginary because there is always at least one real eigenvalue controlling the flow system.

3. we suggest that after a certain amount of strain accumulation if the real eigenvalues exceed the real part of two other complex conjugate eigenvalues, an emerging non - pulsating but stable fabric can be expected.

Finally we stress that within a 3-D flow system, the concept of stable or pulsating

fabric has to be applied more carefully and that further efforts have to be made to

understand the applicability of such mathematical concepts within real geological domains using mechanical constrains.

Ramberg, H. 1974. Tectonophysics, 28, 1-37.

McKenzie, D. 1979. Geophys. J.R. astr. Soc 58, 689 – 715.

Weijermars, R, 1993. Tectonophysics 220, 51-67.