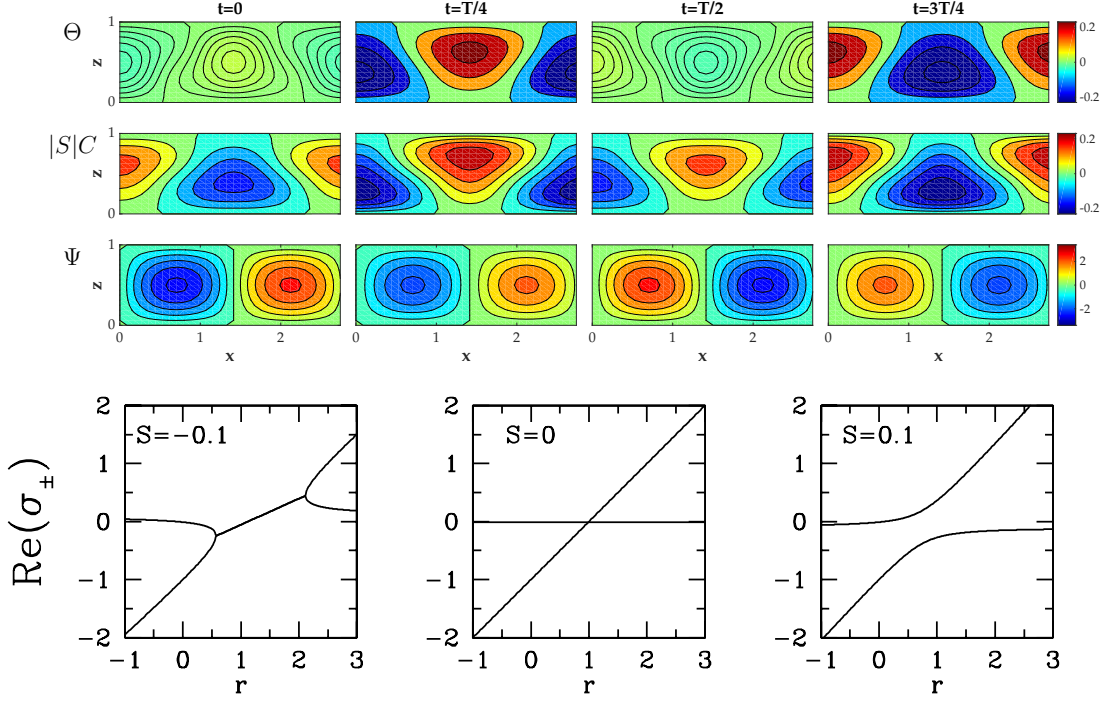


# Binary fluid convection as a two-by-two matrix

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Convection due to two competing or cooperating mechanisms, displays a fascinating variety of dynamical phenomena. One of the physical mechanisms is usually a thermal gradient, and the other may be as diverse as a concentration, rotation, or magnetic field gradient. The transition from a conductive to a convective state is via either a steady or a Hopf bifurcation; the point separating the two was one of the first codimension-two points explored. The bifurcation may be super or sub-critical, and the convection amplitude may undergo a transition from weak to strong.

We show that **all** of these features can be explained as manifestations of the behavior of the eigenvalues of generic  $2 \times 2$  matrix near the point where the eigenvalues intersect.