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Stationary coexistence of hexagons and rolls via rigorous computations

Over the past few decades, the spontaneous formation of patterns such as spatially periodic rolls, hexagonal cell structures, and spiral waves in spatially extended systems has attracted much attention. In the context of the modified Swift-Hohenberg PDE, some of these interesting interfaces can be modelled as stationary fronts between rolls and hexagonal patterns. Via the appropriate change of coordinates introduced in [Doelman, Sandstede, Scheel and Schneider. *European J. of Appl. Math.* 14 (1), 2003], it is known that computing the stationary fronts reduces to computing heteroclinic orbits between equilibria of a given system of second order ODEs. In this talk, we introduce the computational method that has been used to prove existence of some of these connecting orbits, hence leading to rigorous statements about co-existence of different types of non trivial patterns for the original PDE. This rigorous method combines Chebyshev series, the parameterization method of invariant manifold, fixed point theory and interval arithmetics. This is a joint work with J.B. van den Berg, J.-P. Lessard and J.D. Mireles James.