Wavelet methods for regularizing the inviscid Burgers and the 2D Euler equations

Marie Farge
LMD-IPSL-CNRS, Ecole Normale Supérieure, Paris, France

We employ a wavelet representation in the inviscid Burgers equation to anlyse and treat the resonance phenomenon that appears in the Galerkin-truncated numerical solution to this problem. We use the CVS (Coherent Vorticity Simulation) method to avoid the formation of the resonances, obtaining an appropriate regularized solution. The previously developed method with a complex wavelet frame is applied and expanded to embrace the use of a real orthogonal wavelet basis, which we show to exhibit proper results only under the condition of adding a safety zone in wavelet space. We also apply the complex wavelet based method to the 2D Euler equation problem, showing it is able to filter the resonances in this case either.

This work is done in collaboration with Rodrigo Pereira (Instituto di Fisica, Universidade Federale do Rio de Janeiro, Brazil), Romain Nguyen van yen (Fachbereich Mathematik und Informatik, Freie Universität Berlin, Germany) and Kai Schneider (CMI, Université d'Aix-Marseille, France). It has been submitted to Physical Review E.

Our papers can be downloaded from
http://wavelets.ens.fr