

1126-34-260

**Jean-Guy Caputo\*** ([caputo@insa-rouen.fr](mailto:caputo@insa-rouen.fr)), Laboratoire de Mathematiques, INSA de Rouen, 76801 St-Etienne du Rouvra, Normandy, France. *Miscible flows on networks: soft nodes and  $\lambda$  soft graphs.*

To describe the flow of a miscible quantity on a network, for example the flow of power on the electric grid, we recently studied the graph wave equation where the standard continuous Laplacian is replaced by the graph Laplacian. This symmetric negative matrix has an orthogonal basis of eigenvectors. Using these, we obtained amplitude equations which revealed the importance of soft nodes, i.e. nodes where an eigenvector is zero. On these, no forcing or damping is effective and the system cannot be observed or controlled. Because soft nodes are crucial in the dynamics, it is useful to detect them in general networks. For that, we classified small  $\lambda$  soft graphs, that have at least one soft node for eigenvalues  $\lambda = 1, 2$  and  $3$ . In addition, we established transformations connecting members of a given lambda soft class. This approach enables to predict the occurrence of soft nodes in a network or conversely helps build networks with given soft nodes. (Received January 16, 2017)