## 1) Activity report:

During my stay at IMAG, from June 21 to July 19, 2017, I studied in collaboration with Pr. Serge Dumont (IMAG) and Pr. Olivier Goubet (LAMFA-UPJV), a water wave model with a nonlocal viscous term (as half-derivative) of Riemann-Liouville type written in the BBM form. First, we constructed, using MATLAB, a first scheme based on the Gear scheme to approximate the half-order Riemann-Liouville derivative. Then we constructed a second numerical scheme based on the diffusive representation and quadrature methods to approximate the nonlocal term. We presented numerical results on the existence and the decay rate of both linear and nonlinear solutions.

Then, we have studied mathematically the well-posedness of the problem using the diffusive realization approach for the half-order derivative with the Galerkin method. In fact, we observed that the use of the Fourier-Laplace transform method is not helpful due to the form of the nonlocal model.

Moreover, we have compared our numerical results with those given in the literature (like Dumont-Duval, Chen-Dumont-Dupaigne-Goubet) using the Caputo half derivative and (Manoubi, Manoubi-Goubet) for the KdV form.
In addition, I benefited at IMAG of a very good frame and I developed scientific exchanges with people interested in PDEs, modelling and numeric as Rémi CARLES…
Research in progress: We aim to study mathematically the asymptotical behavior and the convergence to zero of the solution in a suitable Sobolev space.

Papers in preprint form: we submitted an article concerning the analysis of the BBM equation with Riemann-Liouville half derivative to an indexed journal.

## 2) Outcome of the research visit:

We proved mathematical and numerical results of existence and decay rates for a new nonlocal water wave model where the nonlocal term is presented by a half- derivative.

## 3) Follow up activities and future implications:

First, a new work will be launched about the asymptotic behavior and the convergence of the nonlocal model.  Also, the results developed at IMAG are a part of my work to prepare my habilitation thesis to supervise research in Tunisia.