This document describes the time advantages obtained vis-a-vis the deviation of results of the simulation of various problems by replacing the FFT routine of OOMMF with the FFTW routine.

The parameters, which were the same for all the problems, were the following:

1) $\mathbf{M}_s$(saturation magnetization) of the material was 8 x 10^5 A/m.
2) A(exchange stiffness) of the material was 13 x 10^{-12} J/m.
3) Anisotropy- Uniaxial anisotropy, with the *y* axis being the easy axis direction, and with K(anisotropic constant) equal to 5 x 10^{-4} J/$m^{3.}$
4) α(damping coefficient) equal to 0.5.
5) The direction of the initial magnetization was such that it made an angle of 90°, with the *z* axis, and its projection, on the *x*-*y* plane, made an angle of 89° with the *x* axis.
6) The applied field was varied from 100 mT to 0 mT, in equal steps, along the *x* axis.

The Euclidean norm(enorm) was considered as the metric for comparison of results. This norm is the magnitude of the difference of the magnetization vector, at each point of the geometry, between the OOMMF simulation and the FFTW simulation.

Mathematically, if there are two vectors ***X*** and ***Y*** given by

$$X=[x_1 \;\; x_2 \;\; x_3];\;\; Y=[y_1 \;\; y_2 \;\; y_3]$$

then the Euclidean norm between them is defined as

$$e=\sqrt{(x_1-y_1)^2 \;+\; (x_2-y_2)^2 \;+\; (x_3-y_3)^2}$$

A colour plot, of this norm at every point of the geometry, was generated.

The following table documents the improvements in time and the enorm plots.

S. No	Details of the problem (grid size;number of iterations in each stage[1])	x dimens-ion(in μm)	y dimens-ion(in μm)	Total time difference(in %)	Time difference in FFT routine(in %)	Enorm plot
1	64x128;200	1	2	4.92	25.42	Figure 1
2	256x512;1000	1	2	7.03	27.30	Figure 2
3	1024x2048;1000	5	10	7.35	26.27	Figure 3

The improvement in time, as the complexity of the problem is increased, is evident. The difference in results is present only at domain wall junctions(as is evident from the figures).

1 A stage is defined as the simulation for a particular field step.

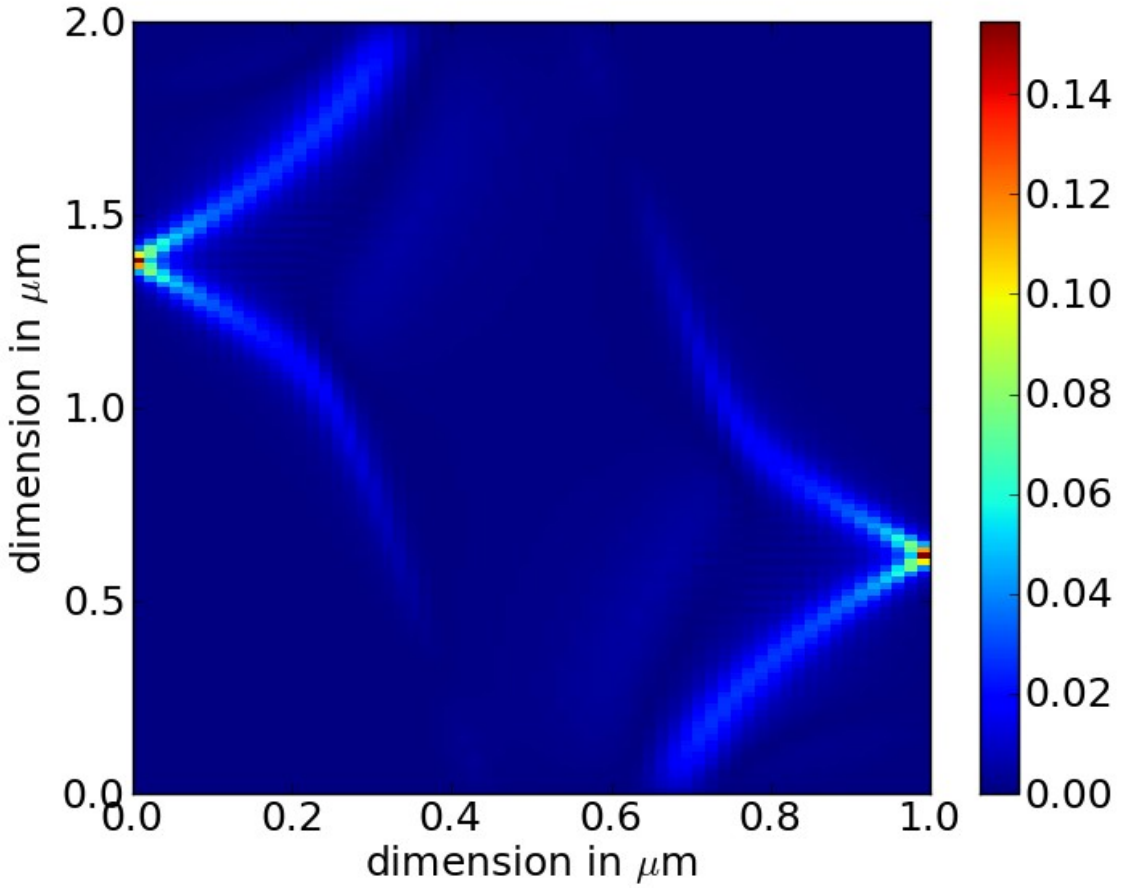

Figure 1 : Euclidean norm plot for Problem 1 [Back to table]

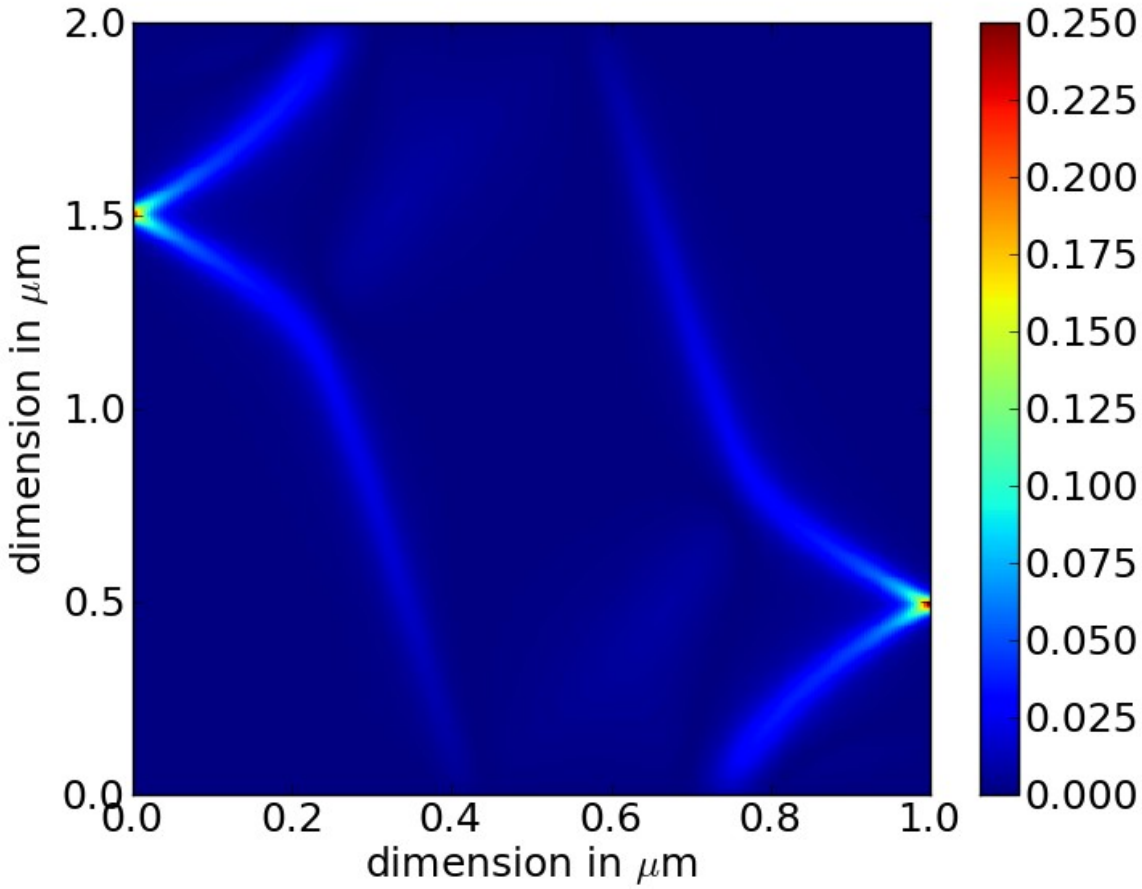

Figure 2 : Euclidean norm plot for Problem 2 [Back to table]

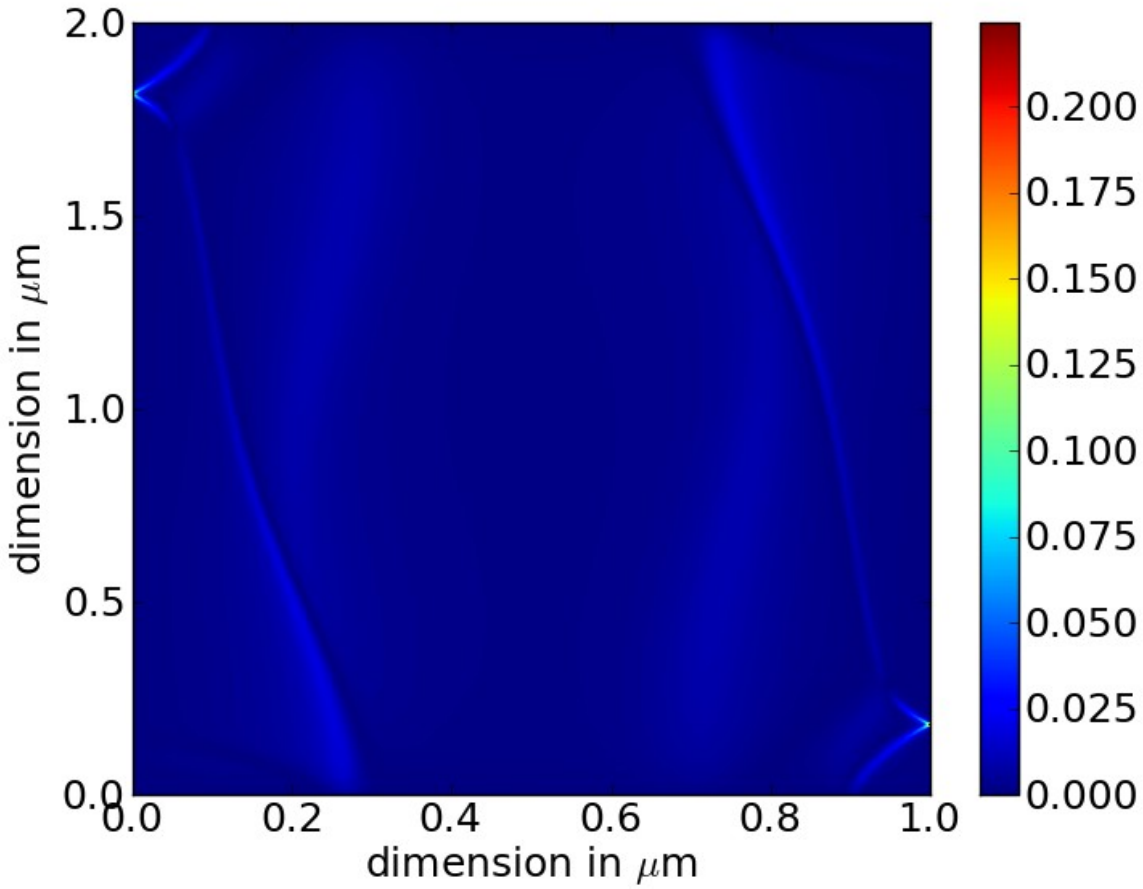

Figure 3: Euclidean norm plot for Problem 3 *Back to table*