Obtaining Uniform B Field in Iron Rod

It is noted that the iron cores used in the Stromerzeuger as described in the Hudson letter used three separate windings. It has been postulated that this could have been a method for obtaining uniform B field over a significant length of the core, that uniformity being a prerequisite for obtaining the ferromagnetic resonance needed to pump electrons via the Larmor precessions. This report shows that having separate windings with different ampere-turns so that the mmf's are lowest in the center and increase towards the ends successfully compensates for the geometric demagnetization factor.

Figure 1 shows a set up in FEMM with an iron core around which a conducting sheath carries uniform current density.

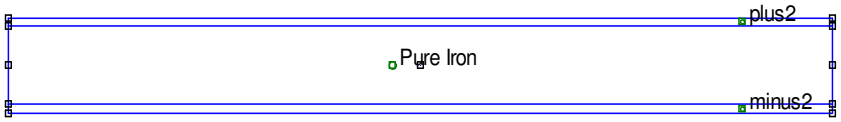


Figure 2 shows the Field lines.

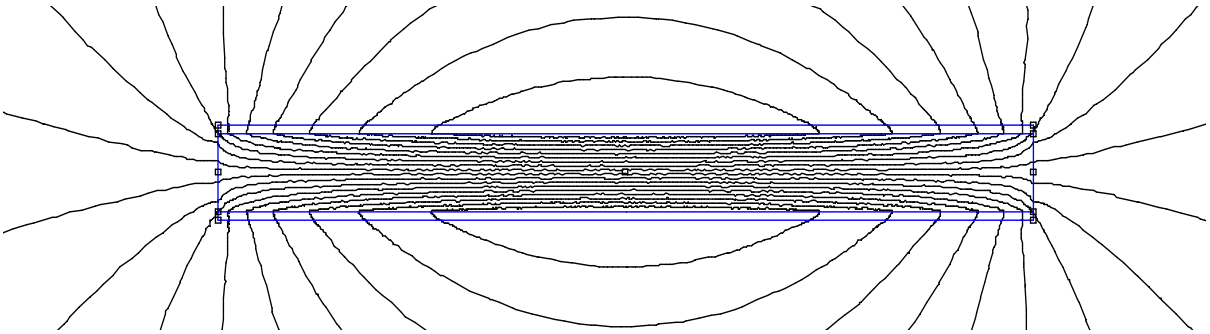
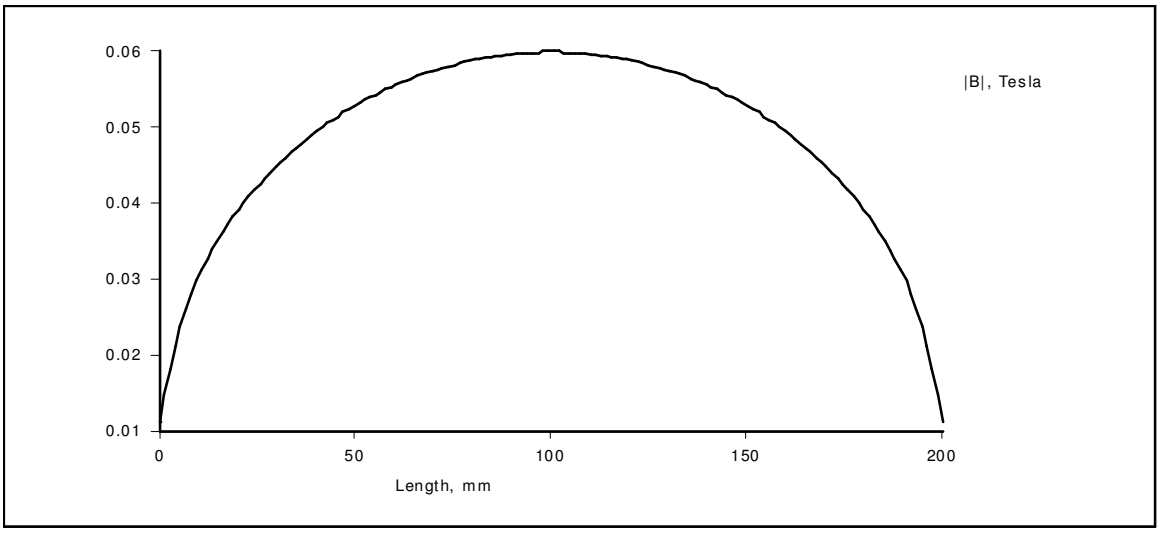
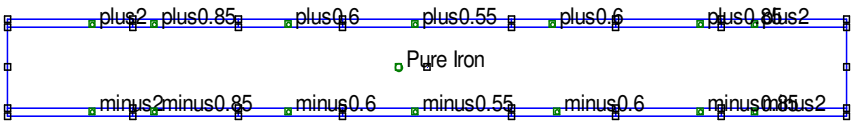


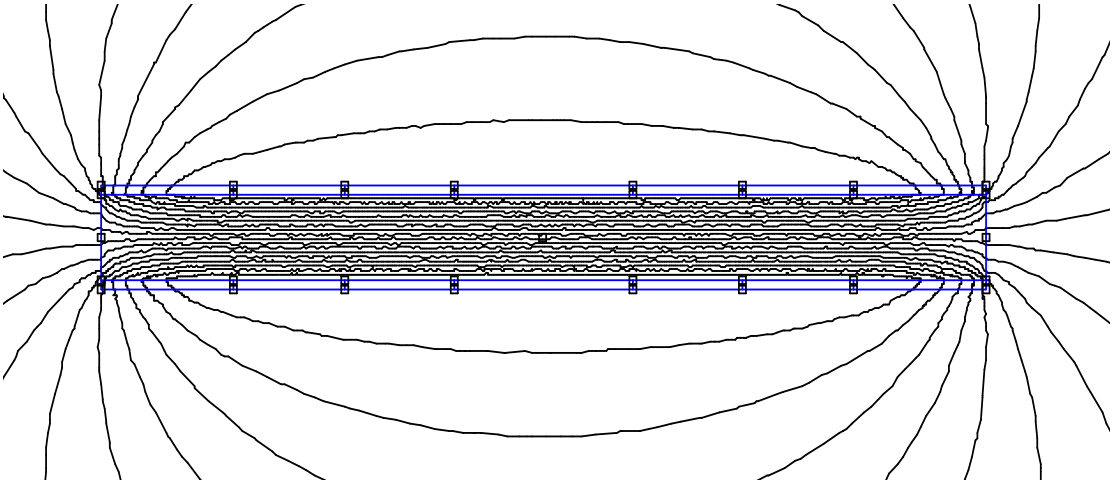
Figure 3 shows the field strength along the center line.



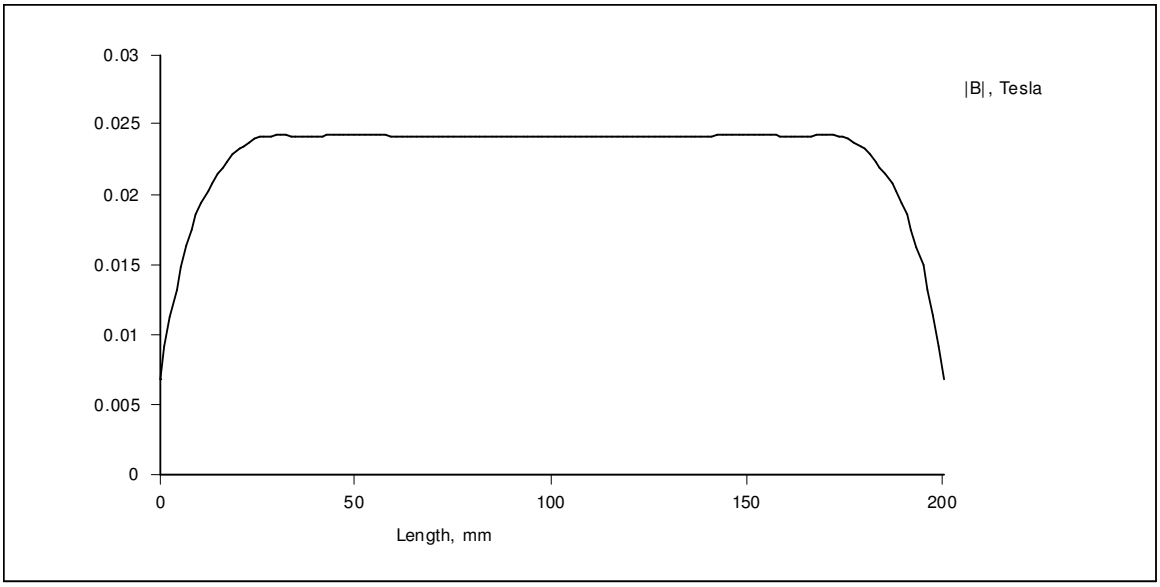
Clearly the field is highly non-uniform over the whole core. The next figure shows seven coils with tapering currents.



Yielding the following field lines.



And here is the chart for field along the center line.



Clearly the use of tapered ampere turns can create uniform field over a significant portion of the core. There is no point in proceeding further with this exercise because FEMM is a 2D model and is showing the field, not within a rod, but within an infinitely long slab. A 3D simulator should enable an optimum coil design to be reached for the cylindrical core.