**PROJECT DESCRIPTION**

This repository contains a comprehensive Lua script for the design and simulation of three-phase induction motors using FEMM (Finite Element Method Magnetics). The script, Full\_IM\_Design\_file.lua, combines analytical calculations with complete stator and rotor geometry generation — enabling quick validation of motor performance through flux plots and field distribution.

**WHAT'S INSIDE THE SCRIPT?**

The Full\_IM\_Design\_file.lua script includes:

* Electromagnetic design calculations:
  + Turns per phase, current, flux linkage, slot sizing, torque
* Slot geometry and drawing:
  + Supports 5 stator shapes and multiple rotor types
* Material definitions and FEMM setup:
  + Assigns core, conductor, shaft, and air materials
* Winding logic:
  + Automatically assigns winding labels based on electrical angle
* Airgap and tooth sizing logic
* Rotor design with customizable shapes (e.g., keyhole, trapezoidal)
* FEMM-compatible drawing commands for full model creation

**HOW TO USE**

**Prerequisites**

* Install FEMM 4.2+ from <http://www.femm.info/wiki/HomePage>
* Lua interpreter enabled in FEMM or use VS code with Lua Exatension.

**Steps to Run:**

1. Edit Input Parameters
   * Open the script in any text editor or FEMM.
   * Modify values like output power (P\_out), poles (P), voltage (V\_ll), outer stator diameter (Dos), slot shapes, etc.
2. Run the Script in FEMM
   * Open FEMM → File > Open Lua Script → choose Full\_IM\_Design\_file.lua
   * This draws the stator, rotor, airgap, applies materials, and labels windings.
3. Check Geometry
   * If the design looks off (e.g., turns = 0, or overlapping slots), tune these:
     + Kst\_Ksm\_ratio, Dos, k\_fill, or empirical constants a, b
     + Ensure stator slot height is feasible using Dos - Dis - core thickness
4. Set Boundary Conditions
   * Right-click on each side of the outer square → press Space → choose A1 boundary
5. Assign Air Material
   * Zoom in to the airgap → add Air material.
6. Mesh and Simulate
   * Mesh > Make Mesh
   * Run > Analyze
   * Postprocessor > View flux density plots, B-field, and verify poles

**Notes**

* If error "negative value under square root in Dis/Dos calculation" occurs:
  + Tweak a, b, or increase Dos to ensure a valid design
* If turns = 0 or negative, change fill factor (k\_fill) or adjust Kst\_Ksm\_ratio or Pls\_Pms\_ratio