

I-STEM Software Request - Guide Approval Form

User Details

- Name of Researcher: Aswath Babu
- User Type: [] Ph.D. Scholar [] Postdoctoral Researcher [] Bachelor's ☒ Masters
- Institution Name: Christ University Bangalore
- Institutional Contact No: 080 62689800
- Research Topic: Development of an Expansion- and Temperature-Aware Digital Twin for Lithium-Ion Pouch Cells Using Multiphysics Modeling

Software Request Details

- Software Name: COMSOL Multiphysics
- Justification for Software Request:

COMSOL is used to develop an electro-thermal-mechanical model of a lithium-ion pouch cell, capturing voltage response, temperature rise, and lithiation-induced cell expansion as functions of SoC and C-rate. The model is simulated under different C-rates and dynamic drive cycles to analyze temperature evolution and its impact on battery performance and estimation accuracy. COMSOL enables estimation of cell expansion and internal stress due to electrochemical and thermal effects, providing mechanical state information not available in conventional battery models. The coupled model supports simulation of high-stress operating conditions to study temperature- and expansion-based indicators relevant to fault detection and safety assessment. The detailed COMSOL model is reduced and exported as FMUs for efficient real-time co-simulation. FMUs are integrated with BMS algorithms in Simulink to evaluate SoC/SoH estimation and fault detection under realistic operating profiles.

Guide/Supervisor Approval

I, Dr. Parag Jose C. (Guide/Supervisor Name),

- Confirm that the above-mentioned researcher is affiliated with our institution
- Have reviewed the software request and its relevance to the researcher's academic work
- Approve the software request for research purposes

Approval Confirmation

- I approve the software request
- The software aligns with the researcher's research objectives
- The request meets the institutional research guidelines

Guide/Supervisor Signature: _____

Date: 30/01/2026

Official Stamp/Seal: [Space for Institutional Stamp]

