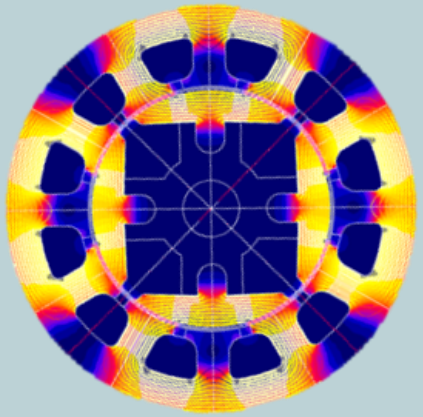


EMDL

Electromechanical Drivetrain Laboratory

اونيۏرسيتي مليسيا فهڠ السلطان عبدالله
UNIVERSITI MALAYSIA PAHANG AL-SULTAN ABDULLAH

Electromechanical Drivetrain Lab

Faculty of Manufacturing & Mechatronics Engineering Technology
Universiti Malaysia Pahang Al-Sultan Abdullah

Contents

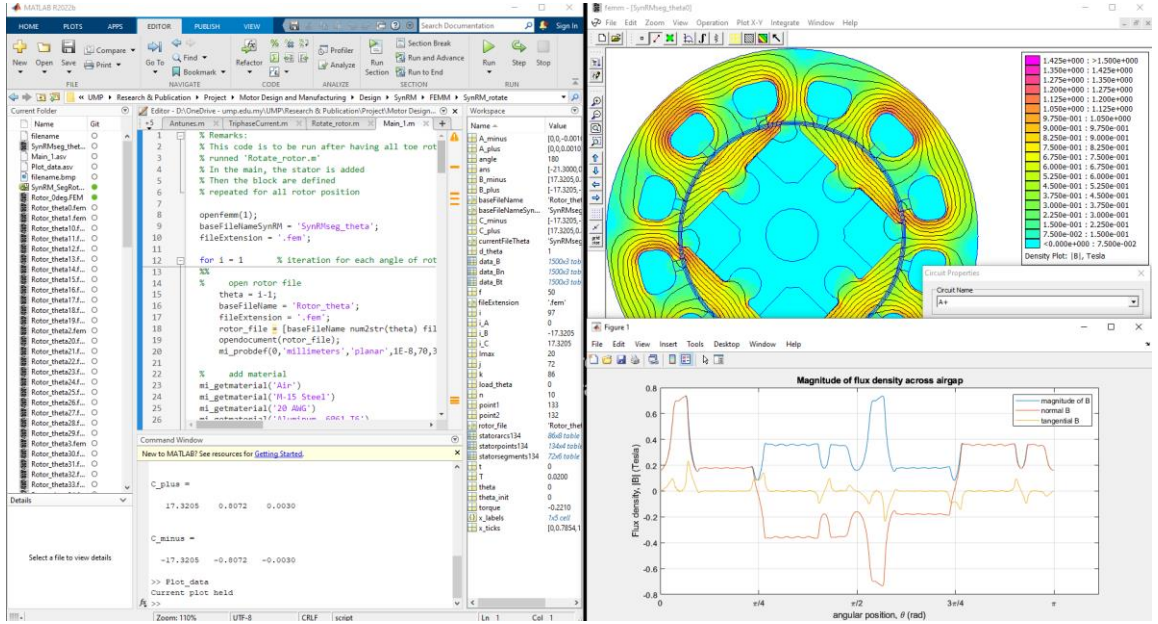
1. Recent work in EMDlab
    1. Design & prototyping of SynRM
    2. Thermal analysis of electrical machines
    3. Others: Vibration and mechanical structure

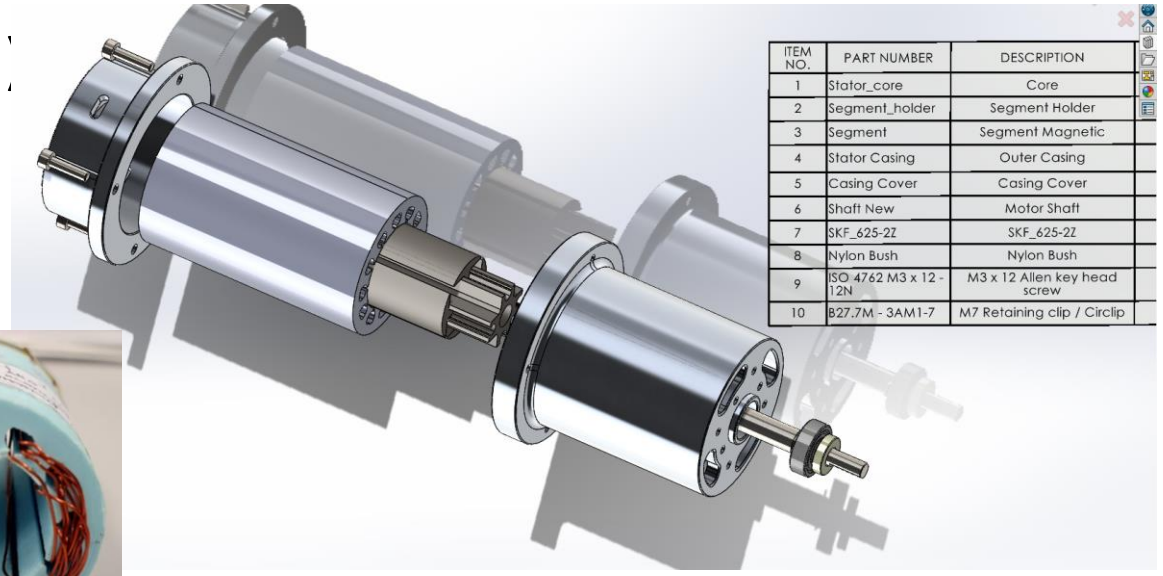
2. Opportunities
    1. Training capabilities
    2. Students
    3. Financial
    4. Partners

Recent works

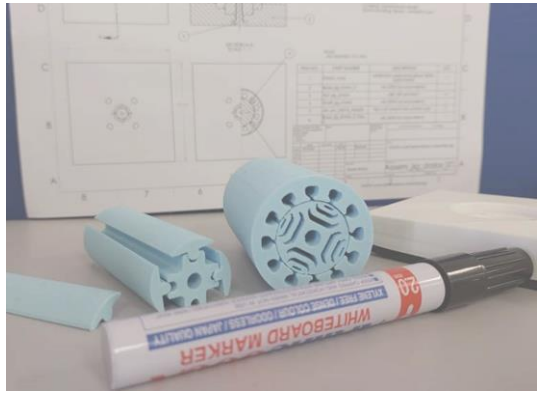
Design & Prototyping SynRM

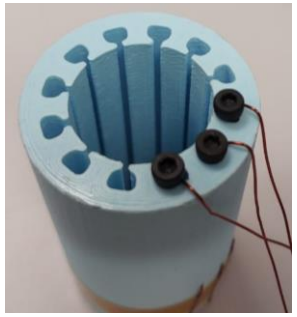
1. FE analysis by FEMM
    1. Parametrization and automation
    2. Optimization/sensitivity study (RSM ..)
2. Manufacturing and winding

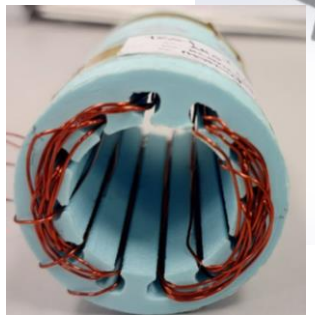




ITEM NO.	PART NUMBER	DESCRIPTION
1	Stator_core	Core
2	Segment_holder	Segment Holder
3	Segment	Segment Magnetic
4	Stator Casing	Outer Casing
5	Casing Cover	Casing Cover
6	Shaft New	Motor Shaft
7	SKF_625-2Z	SKF_625-2Z
8	Nylon Bush	Nylon Bush
9	ISO 4762 M3 x 12 - 12N	M3 x 12 Allen key head screw
10	B27.7M - 3AM1-7	M7 Retaining clip / Circlip

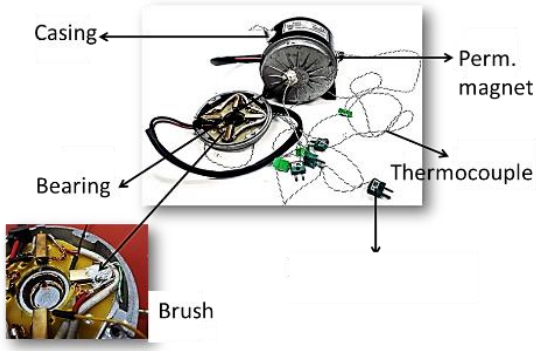


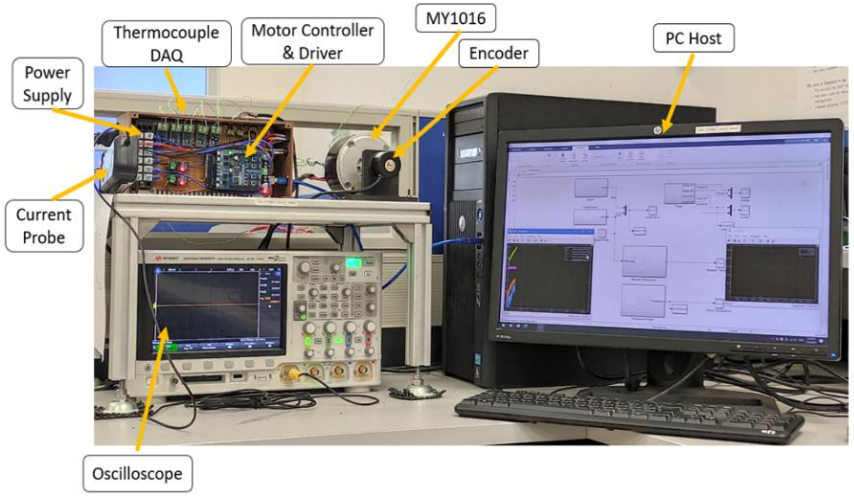




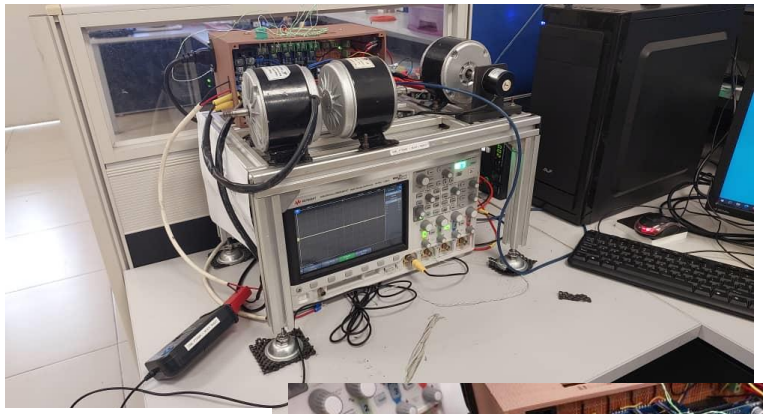
Recent works

Thermal analysis





1. LPTN model development and validation
2. Observation by thermal imaging
3. DC motor controller with integrated temperature instrumentation



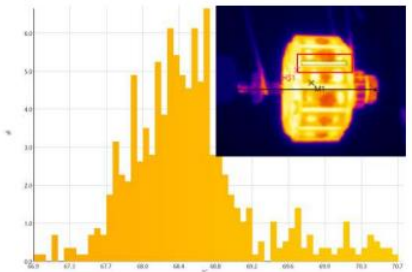


Fig. 6. Winding. Maximum 70.7°C; Minimum : 66.9°C; Average: 68.5°C.

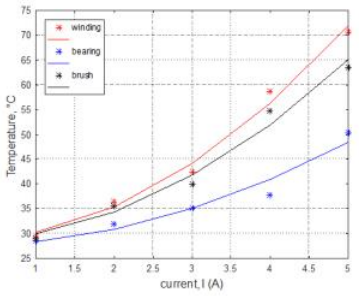


Fig. 9. Maximum temperature of the armature winding, brush and bearin from the thermal image at different current.

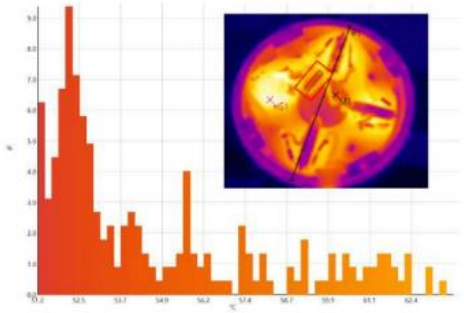
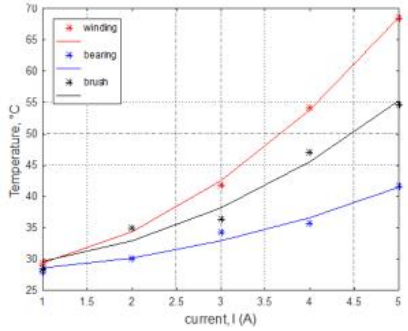
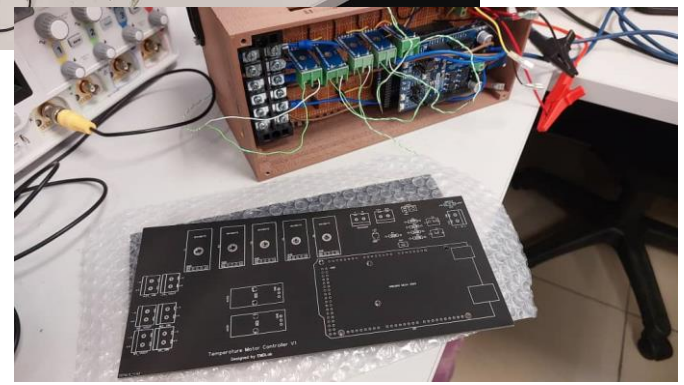


Fig. 7. Brush. Maximum 63.6°C; Minimum : 51.2°C; Average: 54.7°C.

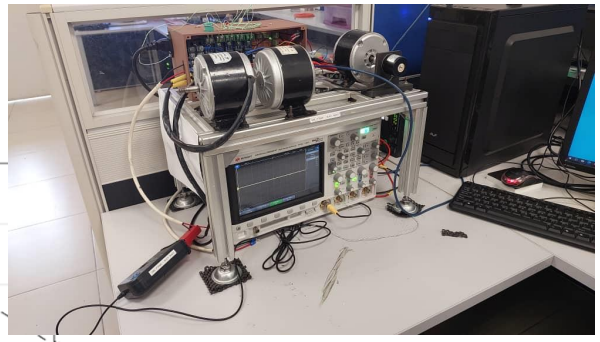


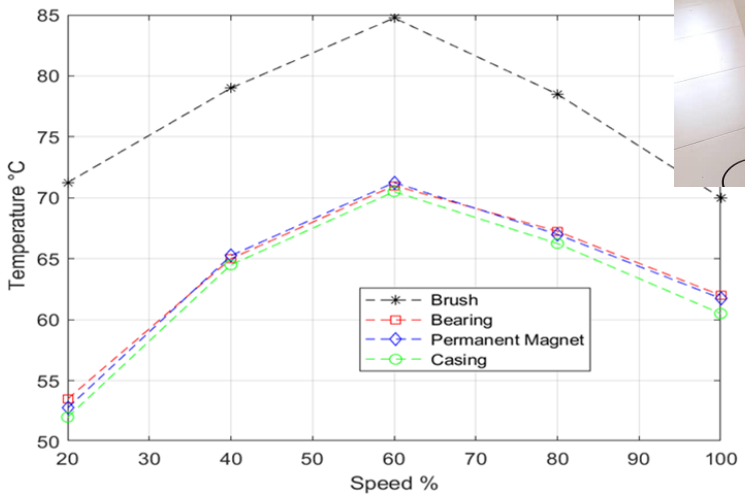


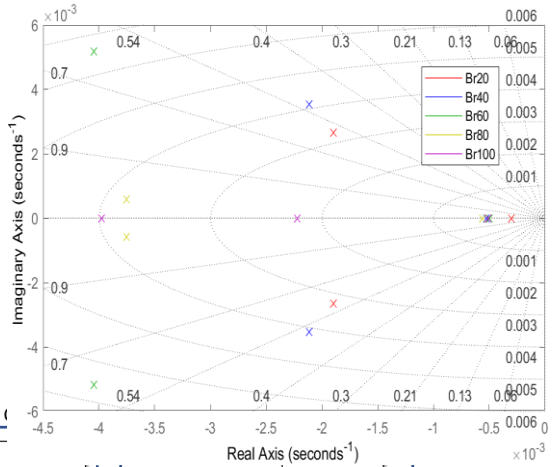
Recent works

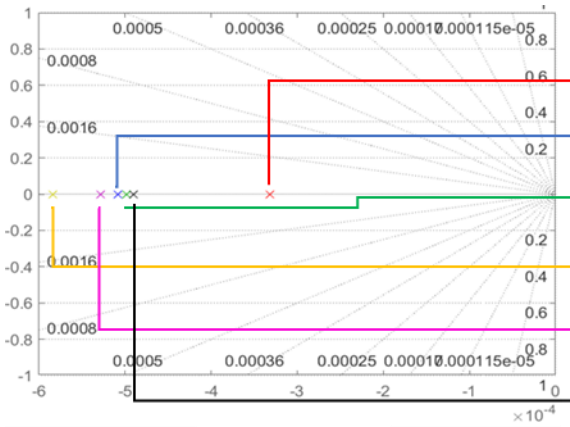
Thermal analysis

4. Temperature response modeling by transfer function for light condition monitoring

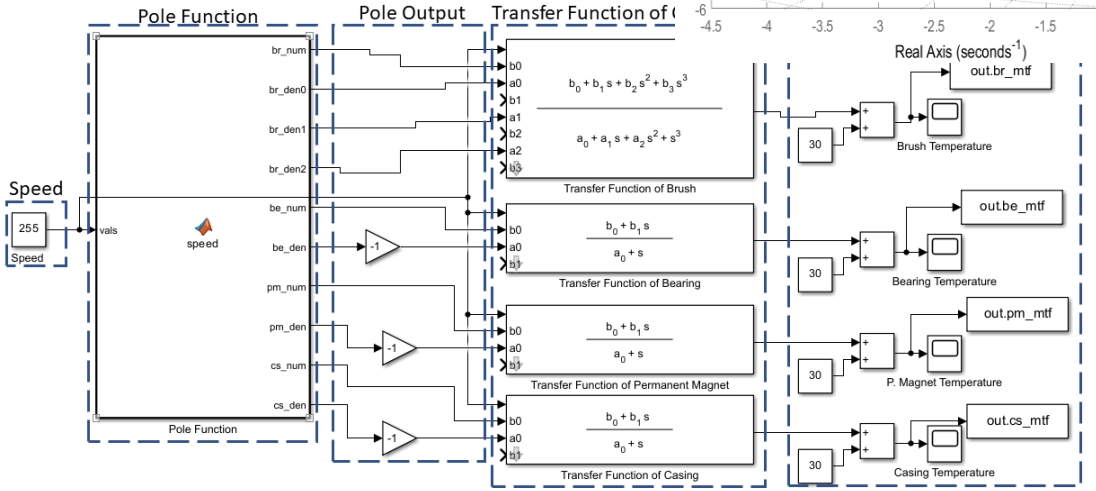








N	$G_N(s)$	σ_N	$\bar{\sigma}$	K_N	$\bar{K}$
20%	$\frac{K}{s+\sigma_{20}}$	σ_{20}		K_{20}	
40%	$\frac{K}{s+\sigma_{40}}$	σ_{40}		K_{40}	
60%	$\frac{K}{s+\sigma_{60}}$	σ_{60}	$\frac{\Sigma\sigma_N}{5}$	K_{60}	$\frac{\Sigma K_N}{5}$
80%	$\frac{K}{s+\sigma_{80}}$	σ_{80}		K_{80}	
100 %	$\frac{K}{s+\sigma_{100}}$	σ_{100}		K_{100}	



Recent works

Others

1. Mechanical: structural (torsional and centrifugal force
2. Vibrational:
    1. Modal analysis – FEA & hammer test
    2. Condition monitoring
    3. Frequency response

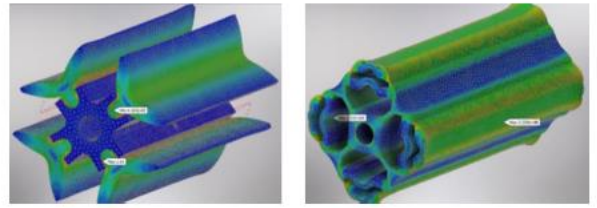
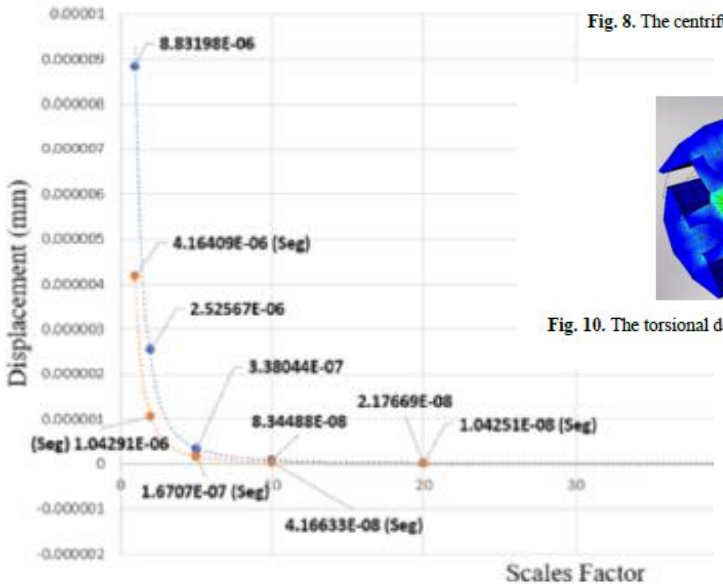


Fig. 8. The centrifugal deformation observed on the segmented (left) and flux barrier(right) rotor structure.



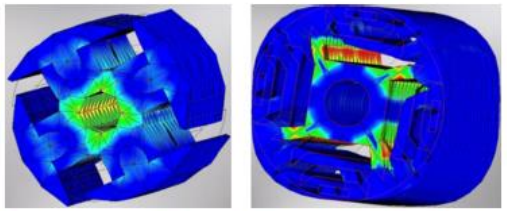


Fig. 10. The torsional deformation observed on the segmented (left) and flux barrier(right) rotor structure.

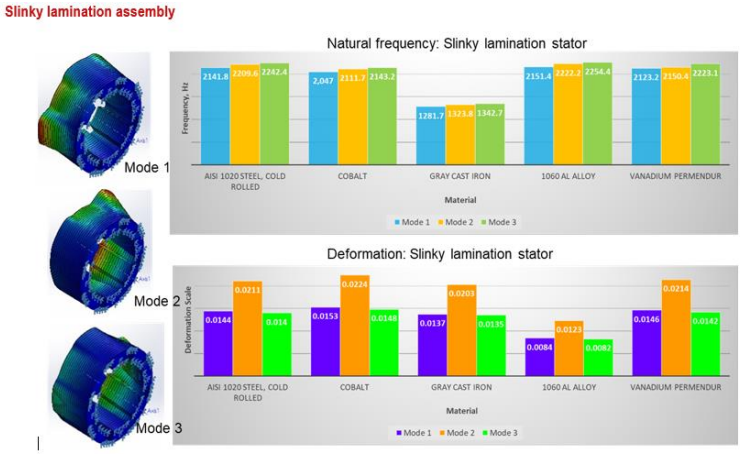
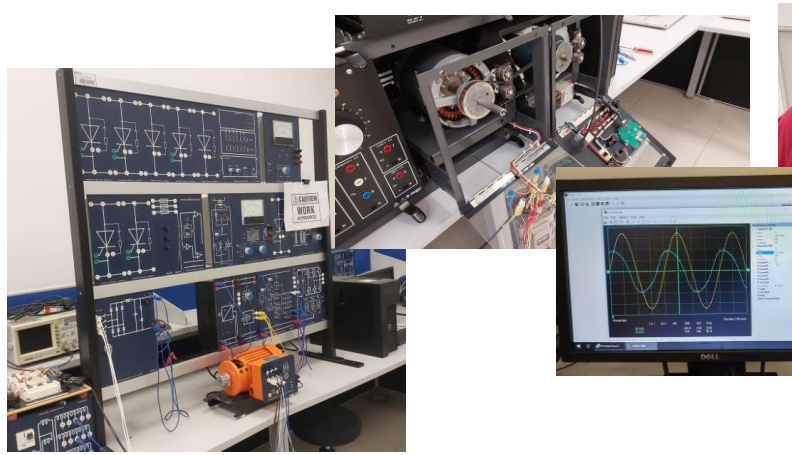
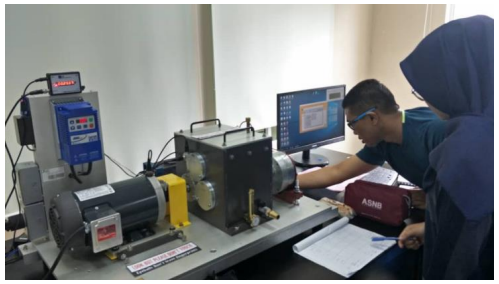


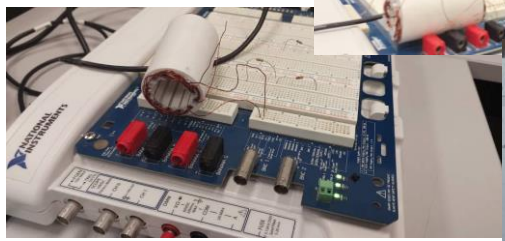
Figure 8. Slinky lamination rotor: the first 3 deformation mode shape. The natural frequency and deformation

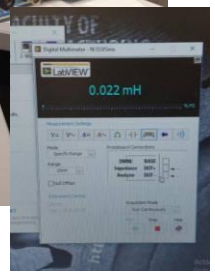
Opportunities

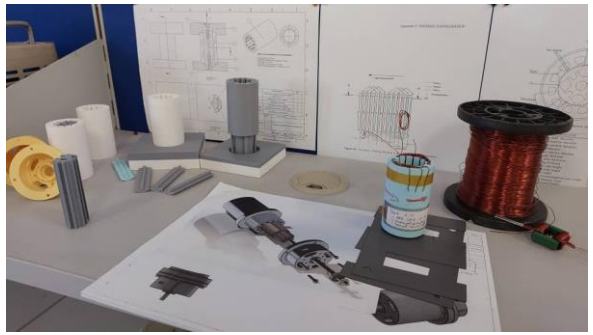
- Training capability
  - Lab facility
    - Power electronics modules
    - Induction machines/dc machines bench
    - Electrical drive vibration bench
    - Impedance / inductance measurement
  - Softwares expertise
    - MATLAB
    - Magnetic FEA (FEMM)
    - CAD & Structural/ mechanical FEA (Solidwork, Inventer, Ansys)

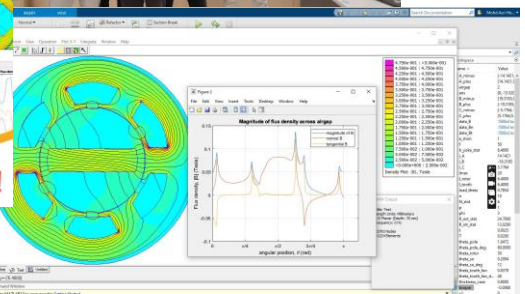












Opportunities

- Students
  - Postgraduates
    - 2 current Masters students
    - Up to 4 Final Year project students every semester (2 semester projects)
    - Open candidature for Msc/PhD all year round
  - Undergraduates
    - Electrical Drive System class – 30 students/sem
    - Analog electronics / power electronics - 30 students/sem
- Financial supports
  - UMP-industry matching grant – 50/50 contribution
  - Internal UMP grant (up to USD 10k / 2 years)

Opportunities

- Partners
  - Industries:
    - Vibratec Asia Pacific (branch of Vibratec France)
    - TT Electronics Malaysia – Kuantan
    - MITS Asia solutions
  - Universities
    - Universite de Technologie de Compiegne (UTC), France – LEC lab
      - Joint research projects, grant and publication
    - Universitas Negeri Yogyakarta, Indonesia – Automotive Department
      - Visiting lecturer (Elec. system), research grant
    - Universitas Negeri Semarang, Indonesia - Automotive Department
      - Visiting lecturer (Elec. system), research grant

Thank you