
monumo
reinventing electric motors

The Disruptive Role of Deeptech in EV Powertrain Engineering

Dr Kevin Bersch

Senior Software Engineer, Monumo

monumo
reinventing electric motors

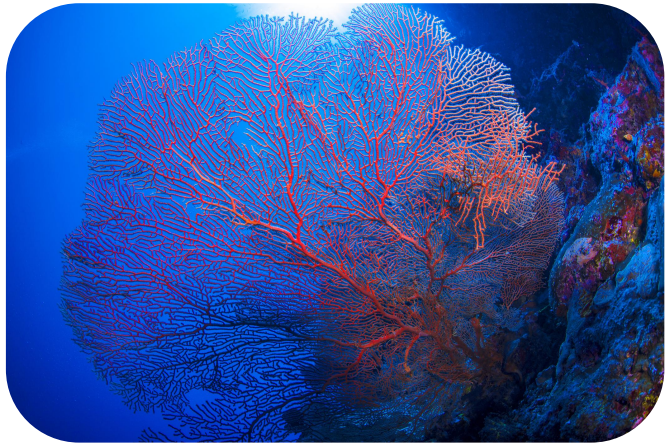
BridgeAI

Ghofer
powertrain

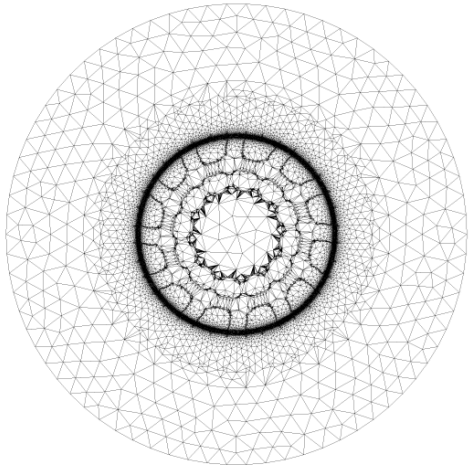
monumo
reinventing electric motors

University of
Nottingham
UK | CHINA | MALAYSIA

monumo

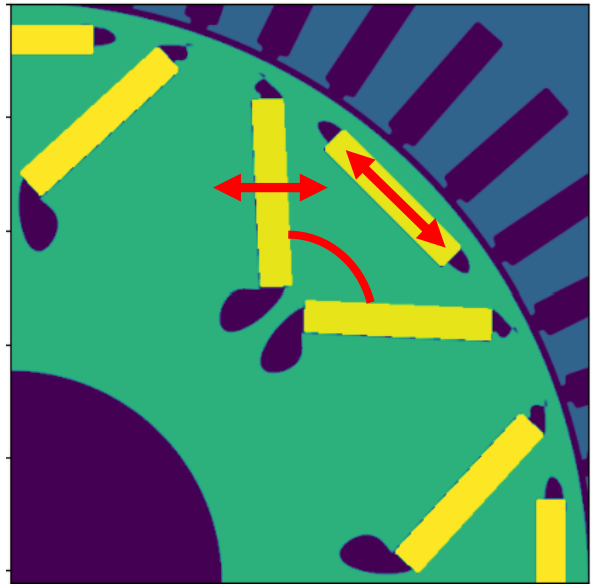


Increasing component geometry freedom



Increasing system coupling

A design space increases exponentially when we increase our input parameter size



~ 5 parameters

10 values each

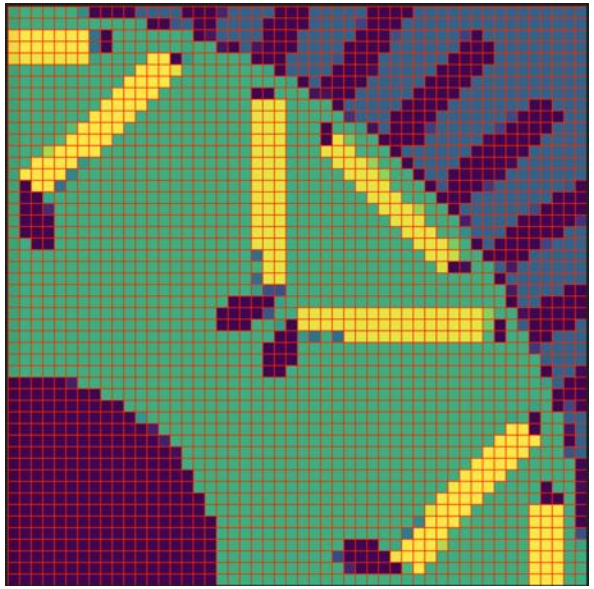
Total designs: 10^5

One sim: 1s

256 CPUs

Total time:

0.5 days



50 x 50 grid

Total designs: 4^{2500}

One sim: 1 sec

All CPUs on earth (100 billion)

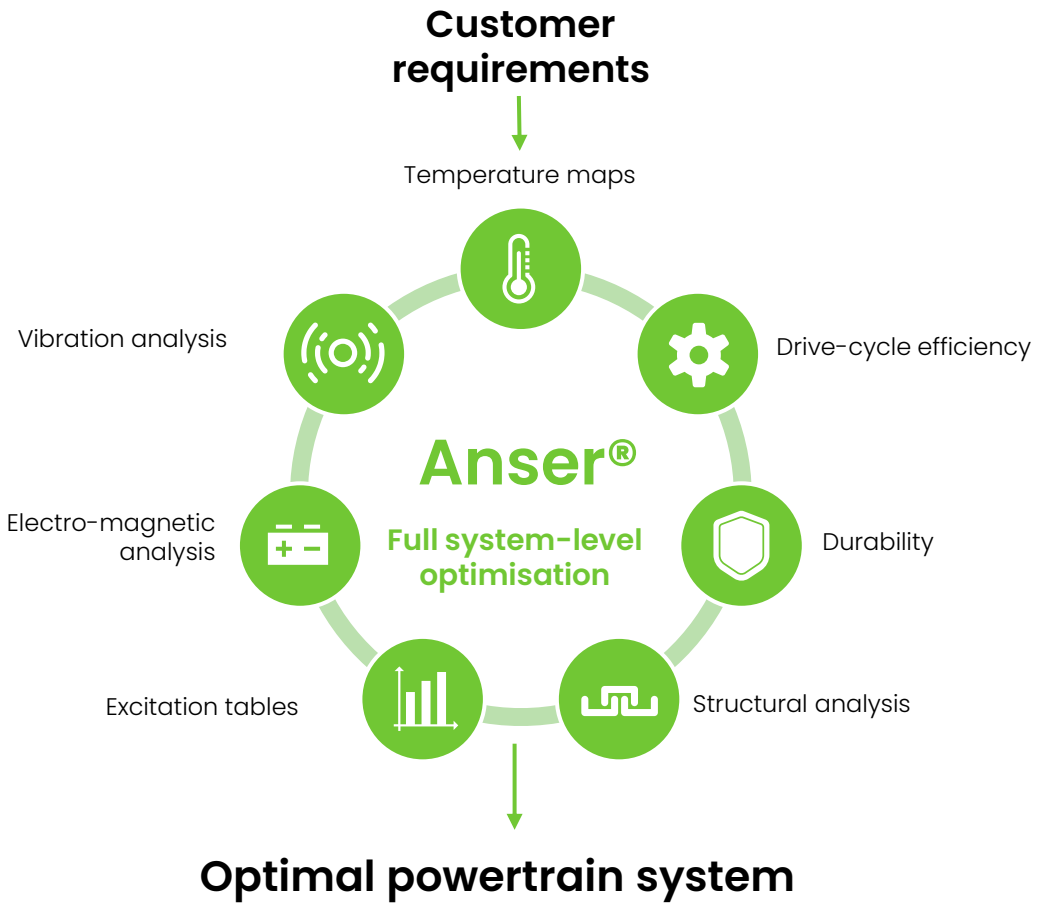
Total time:

Age of The Universe!

monumo

The Anser® Engine

- Automation
- Scale
- Speed
- Intelligence



1st Project Phase: Rotor optimisation

Objectives

- Cost
- Drive Cycle Efficiency

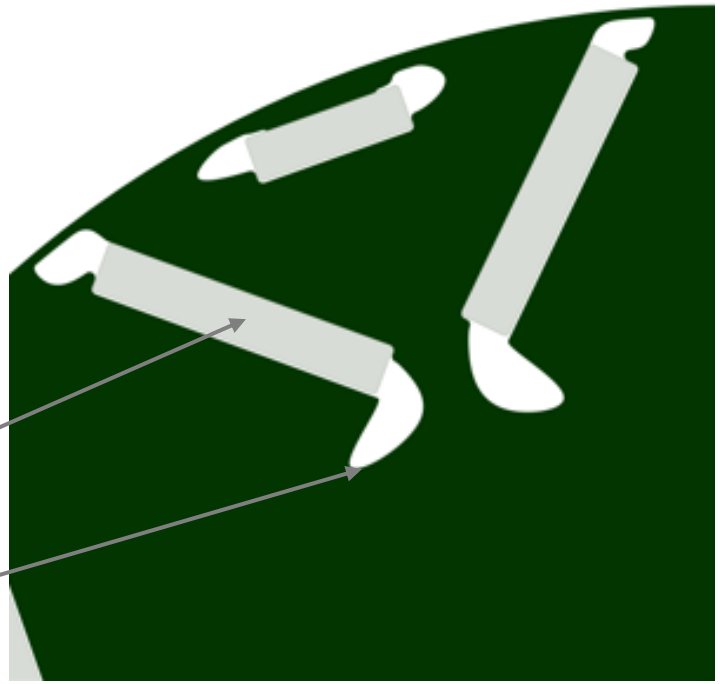
Constraints

- Peak Torque
- Torque ripple
- Manufacturing limits
- Lamination & magnet stress

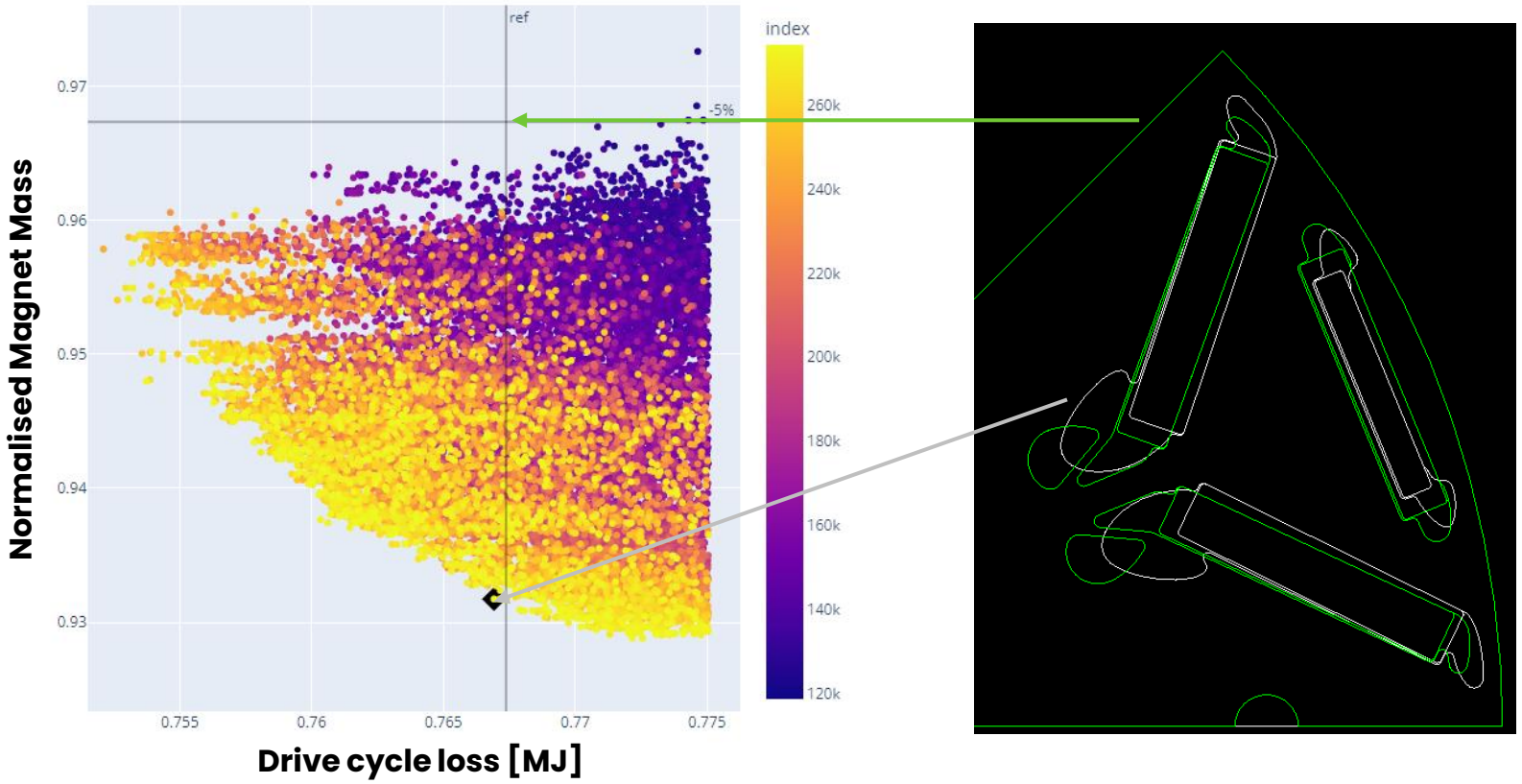
24 optimisation parameters

- Magnet size and position (8 parameters)
- Flexible form air pockets (16 parameters)

Example of un-optimised design



Rotor Optimisation



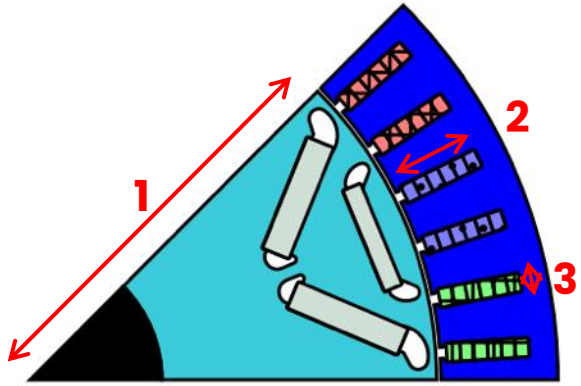
Reduction at reference loss

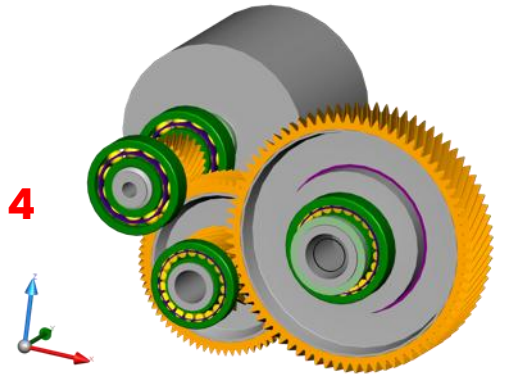
- Cost: -4.1 %
- Magnet: -8.5%

2nd Project Phase: Design space expansion

Gearbox & stator parameters

- Additional parameters
  1. Airgap radius
  2. Stator slot height
  3. Stator slot width
  4. Gearbox ratio

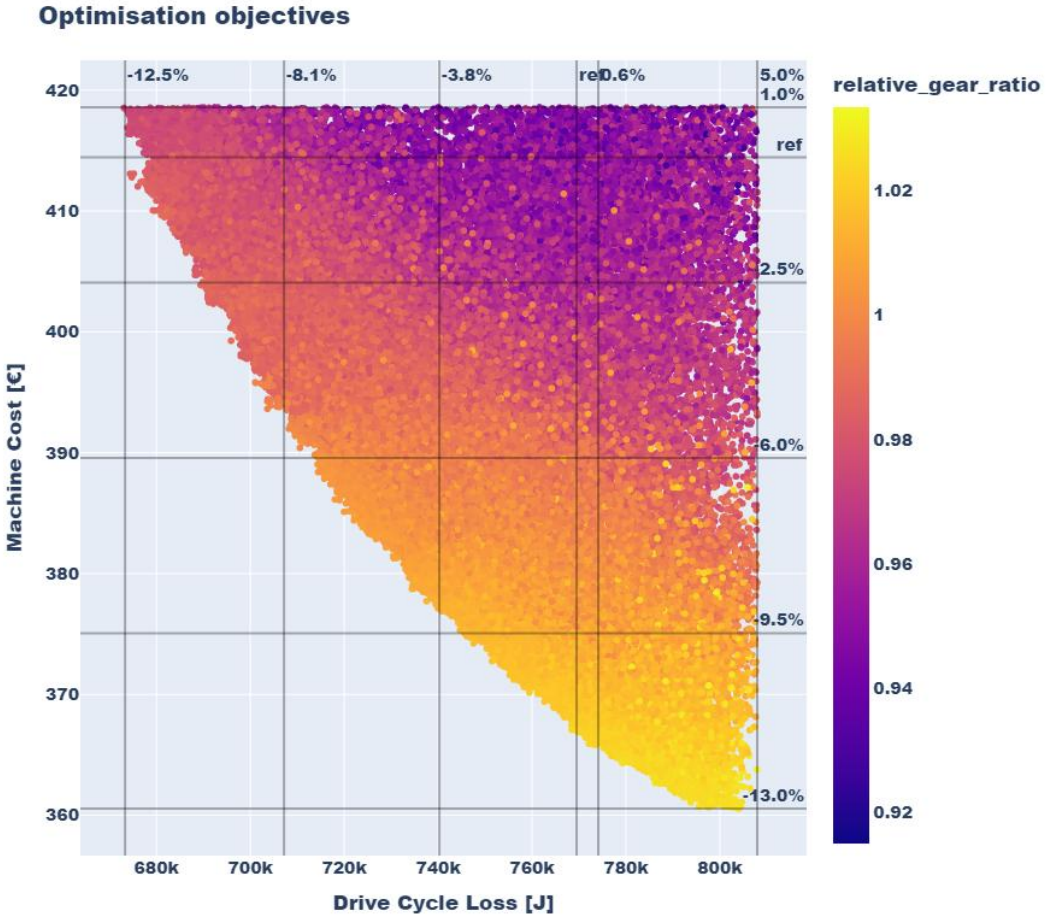




- 28 optimisation parameters
- System level considerations

monumo

Rotor, Stator & Gearbox Optimisation



Reduction at reference loss

- Cost: -11.4 %
- Magnet: -23.0 %

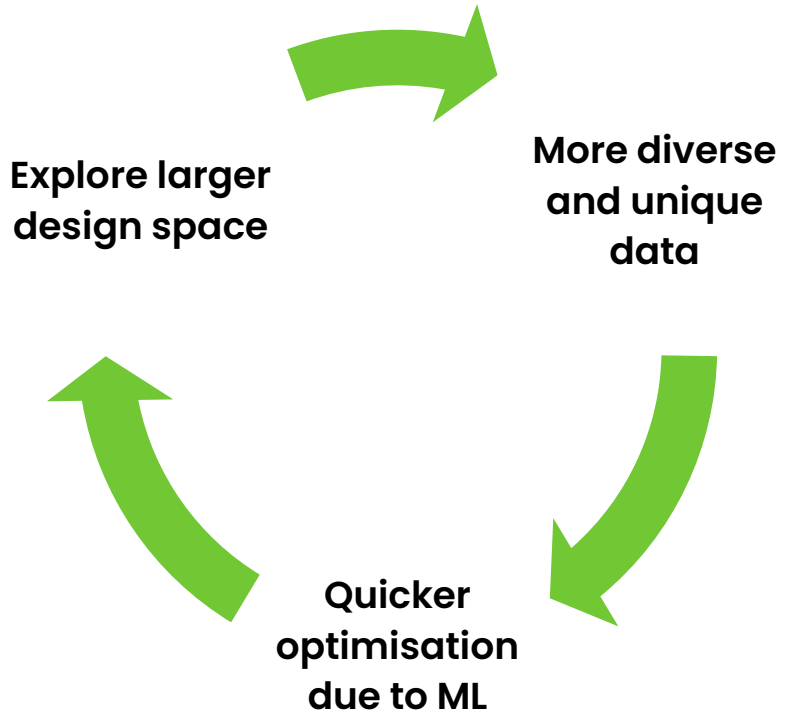
Loss reduction at reference cost: -12.5 %

- 550,000 designs
- ~1 week

Candidate validation currently ongoing

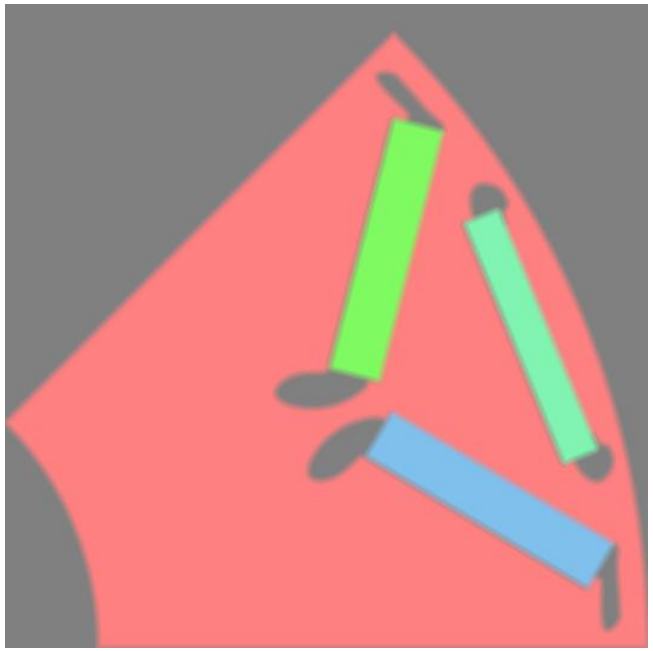
How can ML/AI help?

- Surrogate models to speed up parts of the simulation
- Speed up optimisation by using surrogate gradients or classifiers
- Design space reduction by using Generative AI



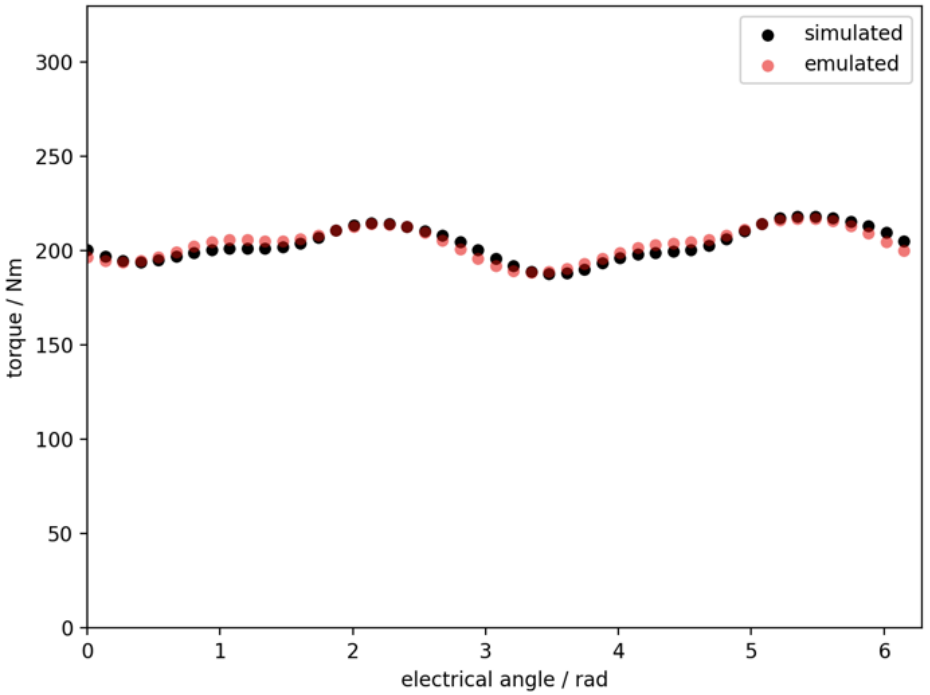
Vision Transformer

Electromagnetic performance prediction



Vision Transformer

- 10x speed-up
- 99 % accuracy

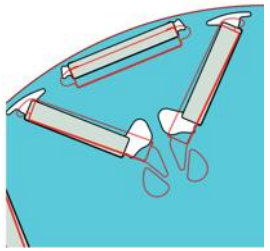


Technology development

Motor only

~5% cost reduction ✓

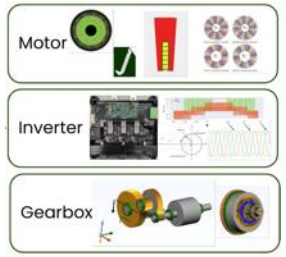
~$25 per motor



System level

10%+ cost reduction ✓

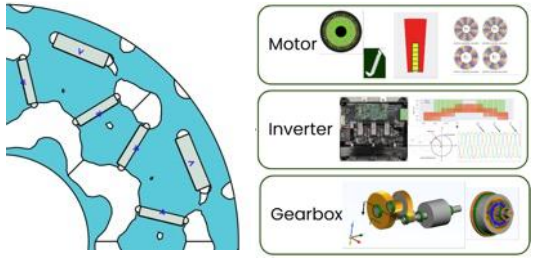
~$50 per motor



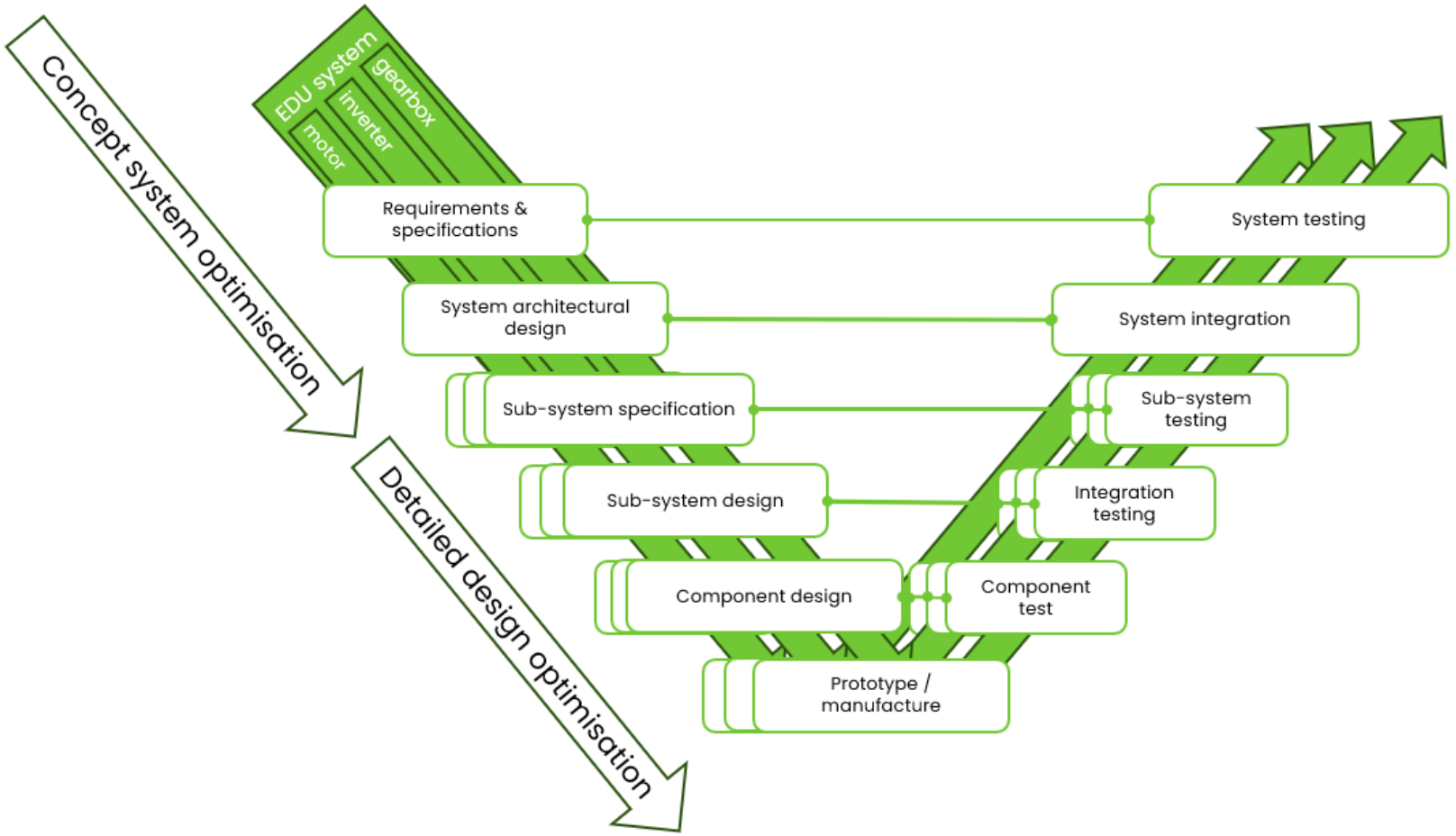
System level + freeform + ML/AI

20%+ cost reduction WiP

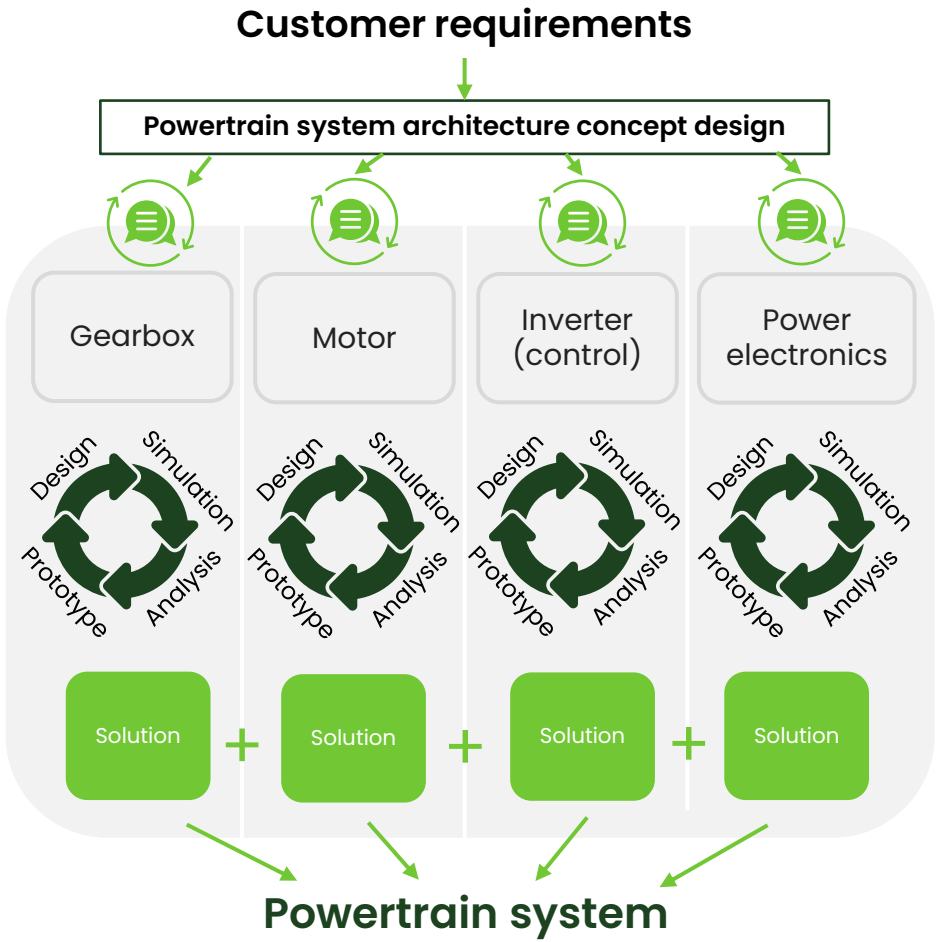
$100+ per motor

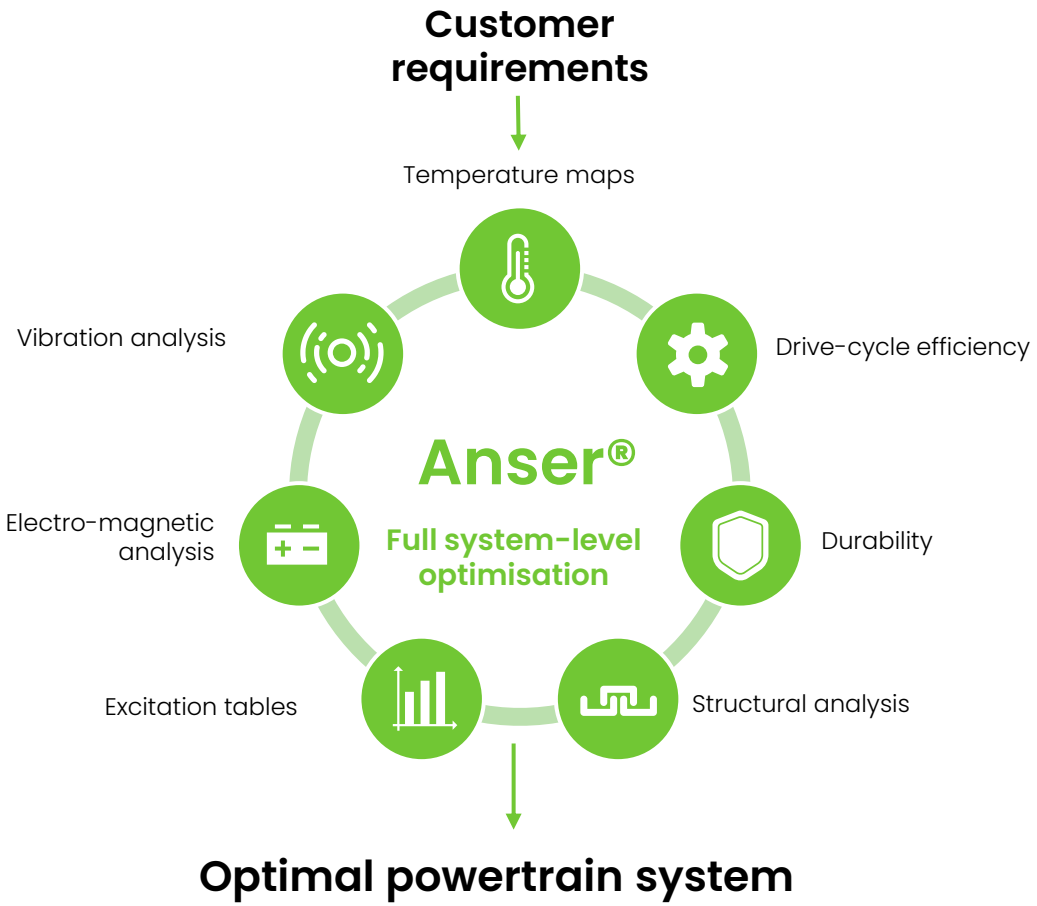


Traditional development cycle



Traditional vs proposed development cycle





Thank you | **monumo.com**

monumo

reinventing electric motors

Appendix

monumo

Vision Transformer

Validation plots