

EXECUTIVE SUMMARY

The automotive industry is experiencing a major transition with regards to powertrain where the traditional internal combustion engine is being replaced by hybrid or all-electric solutions. As a result of this transition, many powertrain engineering firms, such as Integral Powertrain, are required to adapt or develop tools to improve the quality and time to respond to the rapid increase in new electric motor enquiries.

This paper details the development of the foundations of a software tool (AIEED) used to improve the time and quality of response to new motor enquiries. The foundations of the AIEED tool are built into a Microsoft Excel document which contains the necessary logic required to convert customer requirements data into geometrical design data. A series of macros are included in the tool which allow for the automated generation of a first-level computer-aided design (CAD) model of the motor, including the following components; stator, windings, rotor, magnets, housing and cover. The CAD models, which serve to improve the quality of response to new motor enquiries and provide a basis for further detailed development, are generated on the CATIA V5 design platform. In addition, the tool makes use of the CAD model to determine the estimate cost of the unit based on average material costs per unit mass defined in the materials database stored in the tool. It is estimated that the AIEED tool reduces the response time to new motor enquires by 75%.

Certain assumptions and limitations have been applied such that the foundations of the tool only include support for the following motor specifications:

Surface Permanent Magnet Alternating Current cylindrical radial flux motors (external stator and internal rotor).

- The units are designed for 3-phase supply.
- The winding configuration is limited to concentrated double layer option.
- Parallel tooth, arc-bottom, semi-closed stator slot profiles.
- Arc-shaped radially magnetised surface magnet rotor configuration option.

A simple data verification filter is applied to minimise the potential for invalid inputs. However, a full validation and verification process is recommended for future work. In addition, it is recommended that the tool be expanded to support additional motor types and specifications as well as package the foundations into a single, easy-to-use utility.