Electric field control methods for foil coils in high-voltage linear actuators
van Beek, T.A.; Jansen, J.W.; Lomonova, E.

Published in:
Proceedings of the 10th International Symposium on Linear Drives for Industry Applications (LDIA 2015), 27-29 July 2015, Aachen, Germany

Published: 01/01/2015

Document Version
Publisher’s PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

• A submitted manuscript is the author’s version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Download date: 02. Jan. 2019
Electric Field Control Methods for Foil Coils in High-Voltage Coreless Linear Actuators

T.A. van Beek, J.W. Jansen and E.A. Lomonova
Department of Electrical Engineering, Eindhoven University of Technology, Netherlands
email: t.a.v.beek@tue.nl

ABSTRACT
This paper describes multiple electric field control methods for foil coils in high-voltage coreless linear actuators. The field control methods are evaluated using 2-D and 3-D boundary element methods. A comparison is presented between the field control methods and their ability to mitigate electric stress in coreless linear actuators.

1 INTRODUCTION
Increasing demands of the throughput of high-precision positioning systems require more powerful actuators in the positioning stages. Therefore, larger volumes of power cabling is necessary. This results in larger force disturbances and negatively affects the accuracy of the positioning stage. To decrease force disturbances and cable volume, the operating voltage of the actuators is increased. As a result, partial discharges occur above an operating voltage of approximately 700V during the expected lifetime of an inverter-fed actuator. To ensure coreless linear actuators reach their expected lifetime, electric field control methods (FCMs) are employed. These electric FCMs mitigate electric field stress and, therefore, ensures the partial discharge inception voltage is above the operating voltage of the actuator.

In this paper, multiple electric field control methods for foil coils in high-voltage linear actuators are discussed. A comparison is presented between electric FCMs and their ability to mitigate electric stress in coreless linear actuators.

2 ELECTRIC FIELD CONTROL METHODS
Electric FCMs can be distinguished in two main classes [1]. Firstly, capacitive field control concerns electrode profiling, refractive field control and condenser field control. Secondly, resistive field control concerns semi-conductive layers to control electric stress [2].

The effect of each FCM on the electric field distribution is evaluated in conjunction with a high-power dense coreless linear actuator configuration. This configuration comprises a cooling environment, which is connected to PE, foil coils and insulation materials such as epoxy resins and polyimide covered wires. The configuration of the linear actuator is shown in Fig. 1. To investigate the level of mitigation provided by the FCMs 2-D and 3-D boundary element methods are employed, using INTEGRATED’s Electro and Coulomb.

3 CONCLUSIONS
In this paper, multiple electric FCMs for foil coils in high-voltage linear actuators are assessed using 2-D and 3-D boundary element methods. The electric field distributions inside a linear actuator are assessed and compared for different electric FCMs. Furthermore, results are presented on the effect of sizes and material parameters on the electrical field distribution.

REFERENCES