Numerical study of an AC MHD generation with double-side exciting winding


Abstract
This paper studies physical phenomena, performance and optimal operating point of an AC MHD generator under the slip value by using a numerical simulation. The double-side exciting winding of the generator is considered. Its structure consists of a channel, an insulator and stators. Channel type is a flat rectangular and the liquid flows along the channel as a conductor. Channel wall acted as an insulator separates metal fluid and stator coils. The top and bottom stator winding of the generator is connected to polyphase system. Under this condition, it can produce a magnetic field by means of time harmonic function in the same direction of the metal fluid. An interaction between traveling wave and metal fluid is explained by finite element method under Maxwell's equation and Ohm law. The distribution of magnetic vector potential and magnetic flux density throughout channel is evidently shown in xy-plane. Power flow in AC MHD generator is evaluated by slip value. The optimal operating point of an AC MHD generator performance is reported by active power 0.99 kW, reactive power 50 kVAR, mechanical power 1.58 kW, power dissipation 0.59 kW and electrical efficiency 62.5%. © 2010 The Institute of Electrical Engineers of Japan.

Author Keywords
AC MHD generation; Linear generator; Magnetohydrodynamic; MHD induction generator; Mhu generator; Nagaoka university of technology; Plasma application

References
- The energy data and modeling center the institute of energy economics (2008) APEC Energy Handbook 2006,
- Wang, T.C., Dudzinsky, S.J.
Comparison of MHD induction generator analyses

- Dudzinsky, S.J., Wang, T.C.
  MHD induction generator

- Cerini, D.J., Elliott, D.G.
  Performance characteristics of a single wavelength liquid-metal MHD induction generator with end-loss compensation
  (1968) AIAA J., 6, pp. 503-510.

- Jackson, W.D.
  (1962) Classical Electrodynamics,

- Pedro, J., Bastos, A., Sadowski, N.
  (2003) Electromagnetic Modeling by Finite Element Methods,

- Pierson, E.S., Hanitsch, R., Hiihns, T., Mosebach, H.
  Predicted and measurement finite-width effects in linear induction machines

- Lessmann, R.C.
  Elimination of End Losses in an MHD Induction Generator