

**ON THE FAEDO–GALERKIN METHOD
FOR A FREE BOUNDARY PROBLEM FOR INCOMPRESSIBLE
VISCIOUS MAGNETOHYDRODYNAMICS**

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*I devote the paper to Professor Marek Burnat my boss and friend
(Wojciech Zajączkowski)*

ABSTRACT. The motion of incompressible magnetohydrodynamics (mhd) in a domain bounded by a free surface and coupled through it with external electromagnetic field is considered. Transmission conditions for electric currents and magnetic fields are prescribed on the free surface. Although we show the idea of a proof of local existence by the method of successive approximations, we are not going to prove neither local nor global existence of solutions. The existence of solutions of the linearized problems (the Stokes system for velocity and pressure and the linear transmission problem for the electromagnetic fields) is the main step in the proof of existence to the considered problem. This can be done either by the Faedo–Galerkin method or by the technique of regularizer. We concentrate our considerations to the Faedo–Galerkin method. For this we need an existence of a fundamental basis. We have to find the basis for the Stokes system and mhd system. We concentrate our considerations on the mhd system because this for the Stokes system is well known. We have to emphasize that the considered mhd system is obtained after linearization and transformation to the initial domains by applying the Lagrangian coordinates. This is the main aim of this paper.

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