A GENERAL DESCRIPTION OF ACTIVE RESONANCE SPECTROSCOPIC DIAGNOSTIC TOOLS FOR TECHNICAL PLASMAS*

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This contribution investigates resonance spectroscopic plasma diagnostic. The idea is simple – the frequency dependence of the power absorption is displayed via a rf-signal fed to an antenna. Using the absorption spectrum, plasma parameter like the electron density or electron temperature are calculated. Starting five decades ago [1] numerous concepts based on this idea have been developed as a promising concept for plasma diagnostics in an industrial setting – which means that the proposed methods are robust, calibration free, and economical, and can be used for ideal and reactive plasmas alike.

Based on Hilbert-space methods we derive a solution for arbitrary diagnostic designs. An analysis shows the main feature of this family of methods – its ability to resonate. An interpretation in terms of a lumped element circuit reveals the main weakness of certain realizations [2], a complicated resonance structure, which impedes a clear and simple analysis of the measured spectrum. The multipole resonance probe [3] is presented as an idea to overcome this problem in terms of a high geometrical and electrical symmetry.

[1] K. Takayama et al., Phys. Rev. Lett. 5, 238 (1968)
[2] M. Lapke et al., Appl. Phys. Lett. 90, 121502 (2007)
[3] M. Lapke et al., Appl. Phys. Lett. 93, 051502 (2008)

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