Title: On Self-Oscillating Wireless Power Transfer

Abstract: Conventional wireless power transfer systems consist of a microwave power generator located at one place and a microwave power receiver located at a distance. To realize efficient power transfer, the system brought to resonance and the coupled-antenna mode optimizes in order to reduce the radiation into ambient. In this scheme, moving or varying a receiver results in a necessity of the difficult tuning the whole systems that implies a complex and energy consuming feedback structure. We propose a new paradigm of wireless power delivery where the whole system, including transmitter and receiver, is a united microwave power generator. Instead of first converting DC or 50/60 Hz power into microwaves and then arranging a wireless transfer link between two antennas, in our proposed scenario microwave oscillations directly generate at the receiver location, eliminating the need for dynamical tuning of the system impedances.

Biography: Constantin R. Simovski is a worldwide recognized expert in electrodynamics of metamaterials, including nanostructured metamaterials and metasurfaces operating in the optical frequency range and microwave metamaterials and metasurfaces (such as frequency-selective surfaces, high-impedance surfaces, artificial magnetic conductors, and electromagnetic bandgap structures). He has got experience in a broad scope of electromagnetic problems. His main research achievements comprise three newly suggested numerical methods: that for solving boundary integral equations (method of fictitious currents, together with M.I. Kontorovich), that for solving the governing systems of equations for strongly collisional cold magnetoplasma (modified method of macroparticles), and method of mean fields for fast computation of eigenmodes in photonic crystals of dipole inclusions (together with Sailing He). He has revealed some physical phenomena that were further experimentally confirmed: 1) resonant excitation of ion whistlers by a relativistic electron beam in a cold magnetized plasma; 2) extinction of incident waves in photonic crystals (with P. Belov); 3) low-frequency spatial dispersion in indefinite metamaterials (with a group of coauthors); 4) substrate-induced bianisotropy of plasmonic nanoparticles (with M. Albooyeh), etc. He has explained some wave phenomena such as: standing waves in unbounded resonant arrays, domino-modes in plasmonic waveguides, etc. He has guided the development of metamaterials for enhancement of thin-film solar cells (experimentally realized) and thermophotovoltaic devices (theory). In 1980 - 1992 he was with the Soviet scientific and industrial firm "Impulse". Positions: 1980-1987: engineer, 1987-1988: senior engineer, 1988-1991: leading engineer, 1991-1992: head of a scientific group. In 1992 - 2008 he was with St. Petersburg Institute of Fine Mechanics and Optics (now University ITMO). Positions: 1992-1994: university teacher, 1994-1995, assistant professor, 1995-2001: associate professor, 2001-2008: full professor. From 2008 to present time he has been with Helsinki University of Technology – TKK, now Aalto University. Positions: in 2008-2012 visiting professor, since 2012 - full professor. Hirsch-index (Sep. 1, 2017): ISI Web of knowledge – 36, Scopus - 37; Google Scholar – 40.