

CAMT Seminar

“ADVANCED CONTROL OF PLASMA MEDICAL DEVICES”

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Date: October 27, 2017 (Friday) 14:00-15:00

Location: Main Conference Room (1st floor), Bldg. A12
Center for Atomic and Molecular Technologies (CAMT)
(A12 棟 1 階会議室)

Abstract:

Atmospheric pressure plasma jets (APPJs) have widespread use in plasma medicine. This presentation aims to demonstrate the importance of using advanced control strategies for safe, reproducible, and therapeutically effective application of APPJs for dose delivery to a target substrate. Key challenges in advanced control of APPJs arise from: (i) the multivariable, nonlinear nature of system dynamics, (ii) the need to constrain the system operation within an operating region that ensures safe plasma treatment, and (iii) the cumulative, non-decreasing nature of dose metrics. To systematically address these challenges, we propose a model predictive control (MPC) strategy for real-time control of a radio-frequency APPJ in argon. To this end, a lumped-parameter, physics-based model is developed for describing the jet dynamics, and cumulative dose metrics are defined for quantifying the thermal and non-thermal energy effects of the plasma on substrate. The closed-loop performance of the MPC strategy is compared to that of basic proportional-integral control. Simulation results indicate that MPC provides a versatile framework for dose delivery in the presence of system disturbances, while fulfilling the safety and practical constraints of APPJ operation. In addition, we demonstrate the use of advanced control in experimental APPJ systems. Advanced control can lead to unprecedented opportunities for effective dose delivery in plasma medicine.

(Host: Satoshi Hamaguchi Ext:7913)