Research subject for a Post-Doc position:
'Study of the GW-level semiconductor pulsed power switches with a subnanosecond switching time'

Université de Pau et des Pays de l'Adour | **E2S UPPA** | **SIAME laboratory**

General presentation

The Solid State Pulsed Power (S2P2) E2S UPPA Junior Chair, awarded to Dr Anton GUSEV, the SIAME laboratory of the 'Université de Pau et des Pays de l'Adour' (Pau, France), has suggested a Post-Doctoral Award for 14 months. The successful candidate will live and work at Pau but will also have a close interaction with other international scientific centres.

The "High Voltage Processes" team of the SIAME laboratory has been conducting research in the field of pulsed power for many years (siame.univ-pau.fr). Processes involving high pulsed electrical power have found a major expansion in the industrial world mainly for two reasons: the first is linked to recent technological advances which have made power systems (chargers, switches, energy storage sources) both more efficient and economically competitive; the second concerns changes in environmental regulations which require the implementation of new, less polluting processes, or even the adaptation of existing processes to limit their harmful effects and improve their efficiency.

Nanosecond pulses with GW-level peak power are of interest in environmental pulsed power applications such as greenhouse gas conversion, in medicine for contactless cancer treatment, and directed energy applications. Usually efficiency is increasing with shorter pulse rise time; therefore, a subnanosecond rise time is required. On the other hand, industrial nature of aforementioned applications dictates high average power, long lifetime, and minimum maintenance of the pulsed power generators. These requirements prevent using classic pulsed power solutions based on the gas discharge switches, which suffer from low average power, electrode erosion, and dielectric contamination.

Solid-state pulsed power systems based on semiconductor switches have been proven to be a promising solution for GW-level peak power, industrial-grade pulsed power generators. This work focuses on sharpening nanosecond pulses by means of semiconductor switches, aiming for pulses of 300 kV and 3 kA with a subnanosecond rise time. To increase average power, a high pulse repetition frequency of up to 200 Hz is going to be tested. The research program includes numerical simulation using advanced technology computer-aided design (TCAD) and an experimental part, which consists of upgrading an existing nanosecond pulse generator.

Research required

- Literature review to identify the most suitable semiconductor switch technology (i.e., semiconductor opening switch (SOS) diodes or impact-ionisation semiconductor avalanche sharpener (SAS) diodes).
- Developing a numerical model using Advanced TCAD and validation of the model using experimental results in the nanosecond domain.
- Design and fabrication of the experimental setup to upgrade existing nanosecond generator and obtain subnanosecond rise time.
- Validation of the numerical model in subnanosecond domain; comparison of numerical and experimental results.
- Presentation of the results at an international pulsed power conference.
- Publication of the results in a peer-reviewed journal.

Details of the Post-Doc position

Contract duration: 14 months
Starting date: 01 October 2025
Workload (in percentage): 100 %.
Remuneration: a brut monthly salary of €2,840
Placement: Pau, France

Diploma required PhD Title or an equivalent foreign Diploma in the domain of electrical engineering (e.g., high-voltage, pulsed power or electromagnetism). Research engineer profile could also be sent for this position (for example, MSc degree with experience in pulsed power).

Desirable skills

- Fundamental knowledge of electromagnetism and semiconductor physics
- Experience in the domain of pulsed power or high-voltage technology
- Experience of working with semiconductor TCAD
- Experience with electric circuit solvers and/or electromagnetic software
- The candidate must be capable of performing research without day-by-day guidance and collaborating with foreign researchers (a good level of English is preferable)
- The candidate must be capable of producing reports and manuscripts to be sent for publication to internationally renowned journals. The candidate should also be able to present oral contributions at conferences and present the results in front of sponsors at a general audience level.

Contact: For more information and for applying for this position, please contact Dr Anton Gusev by email at **anton.gusev@univ-pau.fr**; please attach a detailed CV.