IPFS Institute For Plasma Focus Studies
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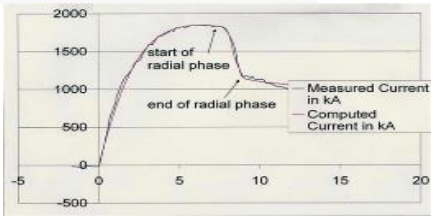

FIRST CITY UNIVERSITY COLLEGE
WAY AHEAD

Numerical Experiments Workshop on Plasma Focus (NEWPF2022)
21 March -6 May 2022 (7 weeks)

Announcing NEWPF2022

This is the 14th Workshop on Plasma Focus Numerical Experiments to be conducted by the Institute for Plasma Focus Studies (IPFS). It is the third one in the series that will be fully internet-based. NEWPF2022 is run by IPFS with support from First City University College (FCUC) as an activity of the AAAPT in collaboration with the Plasma Division of Institut Fizik Malaysia (IFM). A certificate will be issued to each successful participant.

The Universal Plasma Focus Numerical Experiment Laboratory - The Lee Code

This is an exciting time for the plasma focus (PF) community, with reports of experiments at 4 MJ level with 10^{13} D-D neutrons, and plans to further scale up. NEWPF2022 will be based on the Lee Code which readily runs experiments from low energy PF at the J level to 10 MJ and beyond, giving the user data and understanding into each existing and future machine. The standard code simulates any Mathers-type PF in gases including H2, D2, He, N2. Ne, Ar, Kr, Xe and D-T. It calculates the plasma dynamics, energetics, radiation yields including SXR, D-D and D-T neutrons and ions and post-focus plasma flows. It also works for a PF with a converging anode. It is used to design new machines and as a guide for diagnostics. When configured as any existing machine through a measured current waveform it realistically produces the dynamics, energetics and radiation yields of that machine. The latest insight the code has given is into the mechanism of radiative collapse in the plasma focus.

First developed in 1984 as a tool to complement research training for the UNU ICTP PFF package, the code has since become an internationally used numerical research laboratory in its own right. The standard Lee Code (currently RADPFV5.15de.c1 and RADPFV5.15FIB) is based on equations which are mass-, momentum-, energy- and charge-conserved. Development of the code is directed towards laboratory use from an experimentalist's viewpoint. Its pioneering use of fitted mass- and current- factors to represent all mechanisms and effects, known and unknown, beyond those specifically modelled, accounts for the success of the code. This all-encompassing technique is now emulated by other codes. The code also owes its success to many students and researchers for adoption as a major tool for their PF projects, for verification by comparison with laboratory data and for developing code variants for analysing anomalous resistivity, with a more realistic reflected shock phase and for calculating electron beam, for additional gases and twin-gas operation and for automatic fitting of current waveforms. The code has also been adapted to Filippov PF's, spherical PF's, cascading PF's, multi-stage PF's, current-stepped PF's and the theta pinch.

Format of NEWPF2022

This is a 7-week **hands-on course based on the standard code**. Each week the participant will be given a package of material to read, and data from real machines to compare with the results of his/her own numerical experiments. The material will provide detailed instructions for the guided numerical experiments to generate data for comparative studies. The participant has the flexibility to do the 'homework' exercises at own pace and schedule, during the first 4

days of the week. Towards the end of the week, before Friday, the 'homework' will be e-mailed to the instructors who will provide feedback to the participant before the next Monday. The reading material and 'homework' are designed in principle for 6 hours of self-study per week. Communication will be through e-mail. A limited number of Zoom sessions may be included if found to be useful and practicable. Additionally, discussions could also be made through a WhatsApp group, if found to be practicable. A condition for the certificate is that **all 'homework' exercises must be completed satisfactorily as assessed by the instructors.**

Content of NEWPF2022

The course starts with a detailed description of how the PF works, its dimensions and lifetimes, scaling properties and how the Lee Code relates to these aspects of the PF. Then follows an introduction to the EXCEL worksheet, the configuration panel, firing a shot, studying the results of the shot; and the first homework exercise on interpreting and recording data from the worksheet. Then follows work on configuring the code for a specific PF and the fitting of the computed current waveform to a measured current waveform. The participant then generate data using the Lee Code to compare a large PF (the 1 MJ PF1000 of ICDMP in Poland) with a small one (the 400 PF-400J in Chile) to obtain the insight of the constancy of speeds and plasma energy density throughout the range of present-day PF's. Numerical experiments of variations of fusion neutron yield and SXR yield with pressure demonstrate the idea of yield optimization. At very high pressures, a discharge is effectively short-circuited, ideal for circuit analysis. This course will also provide some experience with PF's for fusion energy considerations and doped PF's and new developments in the code including electron beams and radiative collapse.

Application and Participant

In line with the policy and practice of IPFS this course will be provided free of charge. A **participant should preferably already have an interest in the PF and be associated with PF studies or a PF laboratory**. He/she should be able to work with EXCEL worksheet and have access to EXCEL 2003 or later (but NOT EXCEL 2007 which we had issues with).

To register for NEWPF2022 please email to: leesing@optusnet.com.au cc paul.lee@nie.edu.sg and saw.ipfs@gmail.com ;with the following information (items 1-5 in 1 page):

1. Name
2. Designation (e.g. Master student, PhD student, Lecturer, Prof, Researcher, etc)
3. Institution
4. Email address(es)
5. **Reason(s) for wanting to participate in NEWPF2022**.

6. A brief CV (related to research and this course only) and a brief note of recommendation (mainly to **support point 5** for an applicant who thinks such support will help the application).

The dateline for receipt of request to participate is: 19 Feb 2022.
Applicant will be informed of participation status by end February. Successful applicants will receive the first instruction email by the second week of March.

Course Directors and Instructors

The course Director is Prof Sing Lee, with Co-Directors Prof Saw Sor Heoh and Assoc Prof Paul Lee. They are also course instructors. Other instructors include Prof Mohamad Akel.