

	<b>SUJETS DE STAGE PROPOSES PAR LE CEA/CADARACHE DEN/DEC/SESC - ANNEE 2019-2020</b>	Septembre 2019
DEN/CAD/DEC	<b>LIVRET DE STAGES / INTERNSHIP BOOKLET</b>	PAGE 40/41

**Durée :**

6 mois

**Lieu :**

Direction de l'Energie Nucléaire, Département d'Etudes des Combustibles, Service d'Etudes et de Simulation du comportement des Combustibles, CEA Cadarache /13108 Saint-Paul lez Durance

**Formation souhaitée :**


M2 en Mathématiques Appliquées, bonne pratique du C++, bonnes connaissances en développements logiciels, bonnes connaissances de linux

**Possibilité de poursuivre en thèse :**

Oui :  Non :

**Responsable/contact**

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*Candidature à adresser 3 mois avant le début du stage au responsable*

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**Scientific Field:**

Computer Science, Applied Mathematics

**Context: (avec illustration)**

Within the Fuel Studies Department, modeling tools are under development for the sintering process of fuel pellets in order to improve their efficiency. These tools are intended to be capitalized in our software platform PLEIADES. They are based on a library of finite differences, volumes and elements (Diffpack). This library is efficient in terms of the algorithms implemented and the functionalities it offers to application developers, but it requires a refactoring to take into account the evolution of C ++ (C ++ - 11, C ++ - 17 standards, ...), and also no longer use old macros emulating the real C ++ templates. The modernization of this library to the new C ++ standards would also provide the possibility of interfacing with more efficient tools which would accelerate the development phase of new modeling and resolution methods, avoiding to recompile each small modification of code; and also to interface more effectively with external libraries such as CGAL that have incorporated the new C ++ standards.

Once the refactoring step will be completed, the library thus updated will serve to parallelize an application dedicated to the simulation of sintering nuclear fuel.

**Goals:**

The first goal is to modernize Diffpack's Finite Difference, Volume, and Element Library, written in C ++ in the early 2000s, to improve performance: easy to use to develop code, ease to debug, and improve runtime efficiency.

The second objective is to implement this library once updated to parallelize a simulation application of sintering in the case of grains of the same composition (constant and homogeneous composition).

**Steps of the work:**

Appropriation of the diffpack library, based on its sources and the two books written by its authors.

Refresh this library.

Use of the updated library as part of the parallelization of a sintering application.

**Collaborations:**

Collaboration with the Institute of Mathematics of Marseille (I2M UMR7373) Applied Analysis team, K. Saikouk

**Experimental means used (tests, techniques of analysis, characterization...):**

Not applicable

**Calculation tools, computers (languages, softwares):**

PLEIADES calculation servers (Linux environment), Diffpack library, C ++ language, python

**Keywords:**

Finite element library, C ++, refactoring, parallelization

**Duration:**

6 months

**Location:**

Direction de l'Energie Nucléaire, Département d'Etudes des Combustibles, Service d'Etudes et de Simulation du comportement des Combustibles, CEA Cadarache /13108 Saint-Paul lez Durance

**Formation required:**

M2 in Applied Mathematics, good practice in C ++, good knowledge of software development, good knowledge of Linux

**Possibility to pursue with a PHD thesis:**

Yes:  No:

**Contacts:**

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*Application to send 3 months before the beginning of the training course to the person in charge*