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RECENT ADVANCES AND APPLICATIONS OF GREEN'S FUNCTION-BASED POLYCRYSTAL PLASTICITY MODELS

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Models based on crystal plasticity are increasingly used in engineering applications to obtain microstructure-sensitive mechanical response of polycrystalline materials. Three key elements of these models are: proper consideration of the single crystal plastic deformation mechanisms, representative description of the microstructure, and appropriate connection between the microstates with the macroscopic response. The Green's function formalism provides the efficiency needed for the formulation and application of homogenization models (e.g. self-consistent methods [1, 2]), which rely on a statistical description of the microstructure, or full-field models, which requires a spatial description of the microstructure (e.g. FFT-based methods [3,4]). Full-field models are computationally intensive, preventing their direct embedding in multiscale calculations. On the other hand, they can be used to generate reference solutions for assessment of approaches based on homogenization or semi-analytical theories. In this talk we will review our recent efforts to develop material models based on polycrystal plasticity to capture anisotropic strength and ductile damage behavior, along with their integration with emerging characterization methods in Experimental Mechanics (e.g. [5]), and their embedding in Finite Elements formulations (e.g. [6]) to solve problems involving complex geometries and boundary conditions with microstructure-sensitive material response.

References:

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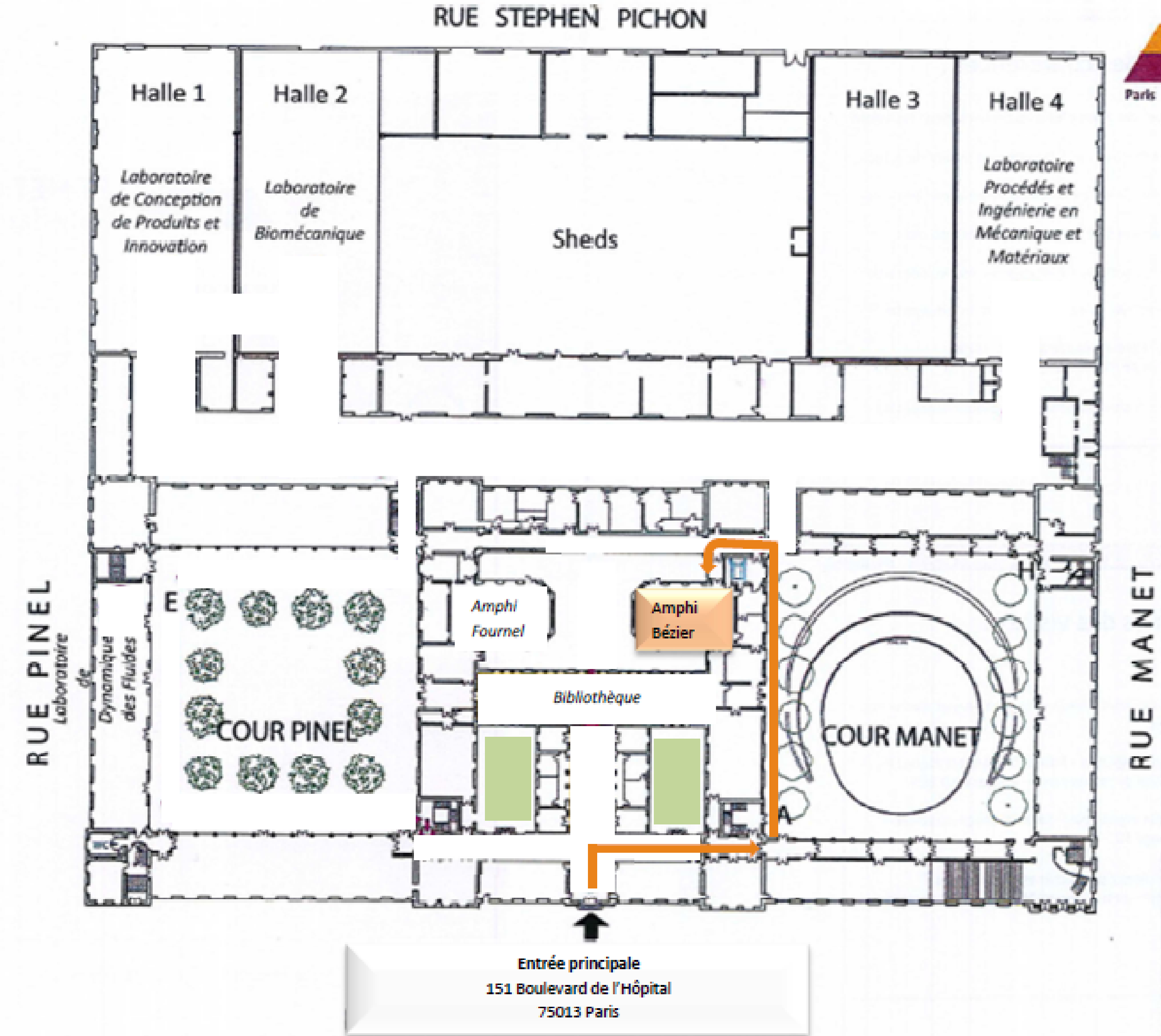

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