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DOCTOR OF ENGINEERING SCIENCES

of **Bram Huygens**

The public defense will take place on **Monday 25th September 2023 at 5:00pm** in room **D.2.01** (Building **D**, VUB Main Campus)

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MODELLING DISPERSION IN CHROMATOGRAPHY: FROM MOMENT ANALYSIS TO NOVEL INSIGHTS

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Abstract of the PhD research

Liquid chromatography is the most frequently used separation technique in, for example, the pharmaceutical or food industry to analyze the composition of complex mixtures. The quality of a chromatographic separation depends strongly on the degree of axial mixing or dispersion occurring during it. The ability to model the axial dispersion in the hierarchically porous separation beds that are being used in chromatography is therefore a crucial prerequisite to better understand current separation performances and develop next generation chromatographic beds. Despite many decades of theoretical efforts, many questions relating to the relation between the degree of axial dispersion and the structural details of the bed still exist.

The present study has contributed to this modelling work by extending the moment analysis methods classically used to model dispersion in ordered and disordered porous media to the more complex geometries and more complex organizations of the different zones and phases encountered in chromatographic beds. Subsequently, these methods have been applied to model and predict the dispersion in a new type of chromatography beds, consisting of parallel bundles of cylindrical channels interconnected by a meso-porous material allowing for diffusional bridging between the parallel channels. In addition, the newly developed methods have also been applied to better understand the relationship between the axial dispersion and the fluid velocity in ordered and random sphere packings.