To the Graduate Admissions Committee,

My name is Leticia Mattos Da Silva and I am a senior undergraduate student at the University of California Los Angeles (UCLA) pursuing a bachelor's in mathematics. I started my studies at UCLA after transferring from a California community college. I am writing this letter to state my interest in entering the EECS PhD program at MIT starting Fall 2021. I hope that my credentials, research experience and interdisciplinary background will demonstrate my ability to contribute to the community at MIT in both its academic and cultural spaces.

My main research interests lie on the intersection between mathematics and computer graphics. My interest in this area grew from taking advanced coursework in differential geometry and topology at UCLA as well as working on geometry processing research under the supervision of Professor Alec Jacobson at the University of Toronto. I hope to continue my endeavors in this field by furthering my coursework during the program while also taking on projects that pursue innovative solutions to problems in computer graphics through the discretization of concepts from mathematics. What drives me to pursue graduate studies in computer science is my goal to continue to conduct research in the relatively new fields of geometry processing and discrete differential geometry.

My current work under the supervision of Professor Jacobson was initially funded by the Fields Institute for Research in Mathematics and continued into a year-long project. We intend to submit our project for publication at SIGGRAPH, the biggest venue for computer graphics research, on January 2021. In our current project, we have established a framework to construct bases of fracture harmonic modes by iteratively solving convex quadratic optimization problems. We present a novel approach to modal analysis of fracture in perfectly elastic materials, a topic of special importance in the simulation of brittle material for graphics applications. During the project, I took on the responsibilities of deriving results and code collaboratively, presenting it to my advisor and other members of the group, writing a technical report and now working towards a publication.

Prior to my exposure to applied research and computer graphics, I worked under the supervision of Dr. Steven Miller at Williams College on a random matrix theory project funded by SMALL Undergraduate Research Experience. This experience was pivotal to my growth as a researcher. As a community college transfer student, this was one of the first steps of a trajectory towards success. I gained experience in coordinating collaboration efforts with peers who were at different stages and had different backgrounds than myself. I demonstrated perseverance, hard work and drive to try to overcome obstacles that arise in the natural course of pursuing novel knowledge. At the end of the summer, I presented results, along with a colleague, in a report talk given at the 2019 Young Mathematician Conference.

In alignment with my interest in geometry processing, I have continued with coursework in areas of relevance, in particular differential geometry and topology. This term I have worked under the supervision of Professor Michael Willis on an individual studies course covering advanced topics in differential geometry and topology. Important tools in geometry processing are constructed from the basic idea of discretizing analogs in geometry and topology. I hope to use my background in these areas of pure mathematics to contribute to innovative connections in geometry processing, in particular in the field of discrete differential geometry, where knowledge of high level mathematics is key to the creation of new

ideas.

In addition to my research experience and coursework, I have dedicated myself to important teaching and inclusion efforts. For the past years, I have worked as a course instructor for the UCLA Center of Excellence in Engineering and Diversity, working with traditionally underrepresented students in engineering and computer science. Along with my passion for teaching, my long standing participation is motivated by my belief that becoming a part of a cutting edge-research community comes with the responsibility to pave way to all, in special groups that historically have been kept at the margins of science. MIT's statement on the role of diversity in its educational mission and its efforts to expand outreach have strengthened my desire to apply for this candidacy.

My ultimate goal is to pursue topics in the study of geometric shapes and their manipulation to facilitate their use in graphics and enable processing of real world driven data. I am particularly interested in how the adaptation of mathematical tools from differential geometry and topology can efficiently tackle meshing and shape analysis problems, necessary for a variety of physical simulations. Motivated by these interests and goals, I have been following the work done by Professor Justin Solomon at the Geometric Data Processing Group. Their recent work on hexahedral meshing, including "Hexahedral Mesh Repair via SOS Relaxation", was especially interesting to me for leveraging the differential geometry aspects of the meshing problem with tools for an optimization algorithm.

More broadly, I am also interested in a wider variety of applications of geometry to graphics. I'd be enthusiastic to explore further ways in which fundamental mathematical aspects can contribute to anything from data-driven methods to design tools. I have found the work done by Professor Wojciech Matusik, at the Computational Design and Fabrication Group, very interesting in a variety of these directions. His paper in collaboration with other MIT authors "Retrieval on Parametric Shape Collections" had my attention for the use of a geometry and topology based algorithm to overcome the difficult challenge of retrieval of shapes.

I believe my background in mathematics together with my experience in geometry processing research are well suited for the many research efforts taking place at MIT that focus on adapting theoretical mathematics to construct algorithms to efficiently process surfaces and volumes in graphics. I would be eager to contribute to projects in these or similar areas and rise to the expectations of taking interesting novel research directions. A PhD will grant me the breath and depth of education and training necessary to be a first-class researcher. At MIT, I will have the resources and guidance to pursue my research goals and in turn I will thrive and contribute to the expansion of the geometry processing field and its applications.

Respectfully,

Leticia Mattos Da Silva.