Statement of Purpose

"Education is not the filling of a pail, but the lighting of a fire."
William Butler Yeats

The story of people who devoted their lives to give mankind the privilege of living in peace and dignity has always been motivating to me. Among them was an engineer who had a torpedo company in Texas in the early twentieth century. He "shot" oil wells back when the technology for completions consisted of dropping a tube of liquid nitroglycerine down a wellbore; it exploded on impact and started the flow of oil. He died in 1954 when a torpedo lodged in a hole, went off, and took out everybody at the surface. Torpedoes were replaced by hydraulic fracturing in the late 1950s.

I have always thought that this accident had a great influence in forming my character. It lit up a fire within me and inspired me to attain specialization in my favorite field of knowledge in order to have a considerable share in paving the way for human being's progress. Being ranked 321^{th} among more than 300,000 participants among nationwide universities entrance exam was a major step towards achieving my goals. It helped me to be accepted to University of Tehran, the oldest and the most prestigious university in Iran.

Now, I am a senior student in Mechanical Engineering department. For the past four years I had the bless to be exposed to a variety of sub-fields in the field of Mechanical Engineering i.e. Computational Fluid Dynamics, High Performance Computing (HPC) and Optimization of Thermal Systems. During the first two years of my undergraduate study, I learned that research is one of the main objectives of my academic life and to this end, I opened the experimental door of my academic life at Vehicle, Fuel and Environment Research Institute (VFERI). By the beginning of fourth semester, I started to work at VFERI under the supervision of Professor V. Esfahanian.

Due to my strong background in mathematics and computer programming, Prof. Esfahanian encouraged me to get involved in "High Performance Computing" (HPC) group. I took the advantage of this opportunity and improved my programming abilities in the terms of parallelism. I initially developed some simple codes by using "Message Passing Interface" (MPI) program. I read some articles about "General Purpose Graphics Processing Units" (GPGPUs) and their marvelous computational ability simultaneously and I decided to work in this novel area. Despite lacking some experts in this field along with software and hardware restrictions, I managed to master myself in GPU programming and started to integrate my engineering knowledge to this fast-growing area in scientific computing.

My first task in this field led to development of a GPU-based Linear Algebra Package (GLAP) for CFD applications. This task was part of a great national project. The aim of this project was to develop an industrial CFD solver. Working with a group of Ph.D. and M.Sc. students helped me to develop in other 'soft skill' areas like communication, leadership and teamwork. At the end of the project, I was chosen to represent my achievements which per se was another bless for a junior undergraduate student. The great success of the project motivated me to work harder in

my favorite research areas. The next step was to implement CFD codes ranging from high order finite difference schemes to discontinuous Galerkin finite element methods on GPUs. The outcome of such an aspiring attitude was outstanding.

My first journal paper entitled “An efficient GPU implementation of cyclic reduction solver for high-order compressible viscous flows” is under minor revision in the journal of “Computers and Fluids”. Also, I have submitted two other journal papers entitled “Towards GPU Acceleration of Discontinuous Galerkin Method Simulation of Compressible Viscous Flow” and “GPU Acceleration of ADIFEM Schemes Using Block Cyclic Reduction Solver” to the journals of “Computers and Mathematics with Applications” and “Computers and Fluids” respectively which are near to publication. It is worth mentioning that my BSc thesis will be on the basis of the mentioned researches I conducted during the last two years at VFERI.

Recently, I was offered by Dr. Pourafshary, an assistant professor of Institute of Petroleum Engineering (IPE) at University of Tehran, to integrate my knowledge to petroleum engineering. I seized this unrepeatable chance to broaden my knowledge of different areas of petroleum engineering ranging from production optimization to reservoir simulation. Now, I am taking Petroleum Production course with Dr. Pourafshary in IPE and working on a paper entitled “GPU Accelerated Streamline Simulation of Multiphase Fluid Flow in Oil and Gas Reservoirs” which will be submitted in the near future.

Considering my background and skills, I have come to the idea that petroleum engineering is an ideal sector in which I can use my expertise to help solve some of the toughest energy challenges we face today. In addition, I am dedicated for playing my part to help meet the world’s growing demand for energy both by unlocking new energy resources and ensuring that our existing oil and gas fields perform at the peak of their potential. I am looking forward to take up a career at the forefront of industry innovation, with outstanding professional development and opportunities to work on the most demanding and exciting energy projects anywhere in the world.

To fulfill these goals, I must take up M.Sc. Petroleum Engineering program. These programs are designed to train professionals in the work-flow concepts now prevailing in the oil and gas industries, and to produce engineers that are fully prepared to work effectively in multi-disciplinary teams. As the world continues to become more globalized, multi-national oil and gas companies all around the world seek graduates who are self-motivated, independent, willing to embrace challenges, and able to cope with diverse problems and situations. Studying in a prestigious university in Netherland provides me with the necessary requirements for future job position. Furthermore, my experience living and studying in a foreign country, negotiating another culture, and acquiring another language will all set me apart from the majority of other job applicants.

Studying petroleum engineering in TU Delft is more than just getting an education. It is the development of one's personal resources in an efficient and industrially oriented way. It requires me to engage in projects that further advance the conservation and environmental aspects of natural resource development. According to my knowledge, Civil Engineering and Geosciences department at TU Delft has a strong program on Computational Fluid Dynamics and Reservoir

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Simulation which is so commendable in Europe. In addition, TU Delft is equipped with high-end facilities which can be utilized to conduct comprehensive researches on petroleum engineering.

Considering the M.Sc. thesis in petroleum engineering division, I am really fascinated by Dr. Hajibeigi's researches on numerical techniques suitable for simulations of multiphase flow and transport in heterogeneous porous media. Implementing large-scale reservoir simulation codes on parallel architecture such as GPUs may lead to considerable execution speed-up.

Also, Professor Jansen's research on systematic optimization of reservoir production is interesting to me. The procedure involves both optimization in a given configuration, e.g. optimizing the injection and production rates in smart well segments, and in a free configuration, e.g. determining the optimal position of sidetracks or infill wells that are typical for the E&P industry. In my opinion, the production engineering course that I have taken in IPE plays a significant role in integrating my optimization skills to petroleum engineering problems.

I strongly believe that my background in fluid mechanics and HPC has potential to contribute to these novel research fields. I feel that graduate study at TU Delft is the most logical extension of my academic pursuits and a major step towards achieving my goals. Therefore, I have found TU Delft the most appropriate place to pursue both my academic and research objectives in the best way possible.

Sincerely Yours,]

Graduate Program Applicant