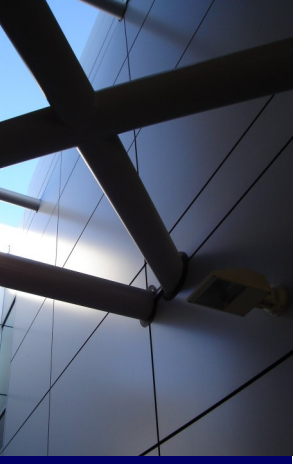

MECHANICAL ENGINEERING
DISSERTATION DEFENSE

The Department of Mechanical Engineering presents:

The Ph.D. Dissertation Defense of

Liem T. Pham

Thursday, December 07, 2017,
10:45 AM in Winston Chung Hall 215

Measurement of Particulate Matter Mass for Atmospheric Monitoring and Very Low Vehicle Emissions

Doctor of Philosophy, Graduate Program in Mechanical Engineering
University of California, Riverside, December 2017
Dr. Heejung Jung, Chairperson

Many assessments of public exposure to particulate emissions associated with illness and mortality are based on the measurements from stationary monitoring sites. The method raises discrepancies and concerns for the real exposure near sources, such as being on the road and living near the highways. This study explored the use of a particle counter and a diffusion charger as a relatively simple means to measure spatiotemporally resolved particle concentrations over a wide region using a mobile platform and accounted for traffic conditions on two major highways in Southern California. On-road testing of cabin filtration systems for different light-duty vehicles was studied using a mobile platform. A stationary monitory site was also setup to study an alternative metric related to particle active surface area, which is regarded as an important metric to correlate particle emissions to adverse health effects. Particle size distributions from scanning mobility particle sizer during ambient monitoring were used to verify the concept. The study found that alternative metrics (number, surface area, and ratio of surface area over number) can be used to monitor spatiotemporally resolved particle concentrations over a wide region.

Gravimetric sampling methods on a chassis dynamometer were also studied in accordance to Code of Federal Regulations. The focus this study was to evaluate commercially available partial flow dilutors with a focus on their equivalency with the standard constant volume sampler system and the ability to provide reproducible measurements at low PM emission levels. As PM standards for light-duty vehicles are becoming more stringent, improving the confidence and understanding the mass measurement methods become one of the main focuses for the industry and regulatory agencies. Simultaneous testing was conducted with three partial flow dilutors over the Federal Test Procedure and US06 drive cycles. The Federal Test Procedure had means that were statistically different for two of the three partial flow dilutors. As for the US06 tests, the mean differences were not statistically different. The performance of all partial flow dilutors also showed repeatable and accurate level of proportionality, which can easily meet the Code of Federal Regulations 1066 and 1065 requirements for all tests performed.