Write a brief statement for each of the following four sections and then check ‘yes’ or ‘no’ for question 5:

1. Statement of the problem, its scope, and rationale.

Problem: Real-time systems in which task parameters are a function of system dynamics make demand characterization and schedulability analysis difficult. Scope: This work covers demand characterization and codesign of real-time systems in which task parameters are a function of system dynamics. Rationale: Incorporation of physical dynamics into real-time analysis can reduce pessimism and increase the efficiency of demand characterization and schedulability analysis while enabling codesign of real-time, cyber-physical systems.

2. Source of the materials, subjects, etc.

Source materials come from real-time conferences and computer science journals including but not limited to: Real-Time Systems Symposium (RTSS), Euromicro Conference on Real-Time Systems (ECRTS), Real-Time and Embedded Technology and Applications Symposium (RTAS), International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), IEEE Transactions on Computers, and various control-related conferences found in databases like IEEE Xplore and ACM Digital Library.

3. Method and design (statistical analysis where applicable).

Methods include Model, Formal, and Experimental. Model methods are used to define abstract properties of real-time tasks in which at least one real-time parameter is a function of at least one physical dynamic. This method requires characterizing the relationship between a real-time task (or set of tasks) and a real-world system in a way that emulates real-world systems. This method also includes establishing properties of these models. Formal methods rely on the use of model properties to develop algorithms for bounding demand from the real-time systems. This method also includes proving any non-trivial properties of the model (such as the relationship between the physical parameter and the demand generated by a particular task). Experimental methods include the simulation of real-world systems either though software or through construction of a real system (such as a small-scale robot). This method relies on experiments to verify the results of the model and formal methods.

4. Hypothesized results (where applicable).

Results are expected to include analytical tools (such as task models, mathematical proofs of model properties, and transformations) for using physical system dynamics (such as limitations on minimum and maximum value, first and second order derivatives) to limit the search space when characterizing the demand of tasks through demand bound functions. Results should also include model relationships between physical system properties and real-time demand, enabling codesign of the system in question. Results will also be supported by case studies either in simulation or in real systems.