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Minimizing System Modification in an Incremental Design Approach
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Summary
- Mapping and scheduling of distributed embedded systems for hard-real time applications
  - Static cyclic scheduling of processes and messages.
  - Bus access scheme: time-division multiple-access.
- Incremental design process
  - Already existing system.
  - Implement new functionality.
  - A) Existing system modified as little as possible.
  - B) New functionality can be easily added to the system.
- Mapping strategy
  - A) Subset selection to minimize modification time.
  - B) Two design criteria, objective function.

Problem Formulation
- Input
  - A set of existing applications.
  - A current application to be mapped.
  - The system architecture.
- Output
  - A mapping and scheduling of the current application, so that the incremental design requirements are satisfied.
- Requirements
  - A) Constraints of the current application are satisfied and minimal modifications are performed to the existing applications.
  - B) New future applications can be mapped on the resulted system.

Mapping Strategy
- Initial mapping and scheduling
- Requirement a) Subset selection problem
  Select that subset \( \Omega \) of existing applications so that the current application fits and the modification cost \( R(\Omega) \) is minimized:

\[
R(\Omega) = \sum_{i \in \Omega} R_i
\]

Three approaches to the subset selection problem
- Exhaustive Search (ES)
- Ad-Hoc Solution (AH)
- Subset Selection Heuristic (SH)

- Requirement b) Objective function minimization:

\[
C = w_1^c (C^c_n) + w_2^c (C^c_n) + w_3^c \max(0, T_{new} - C^c_n) + w_4^c \max(0, B_{new} - C^c_n)
\]