Prelab Assignment
Experiment 5
ECE 482

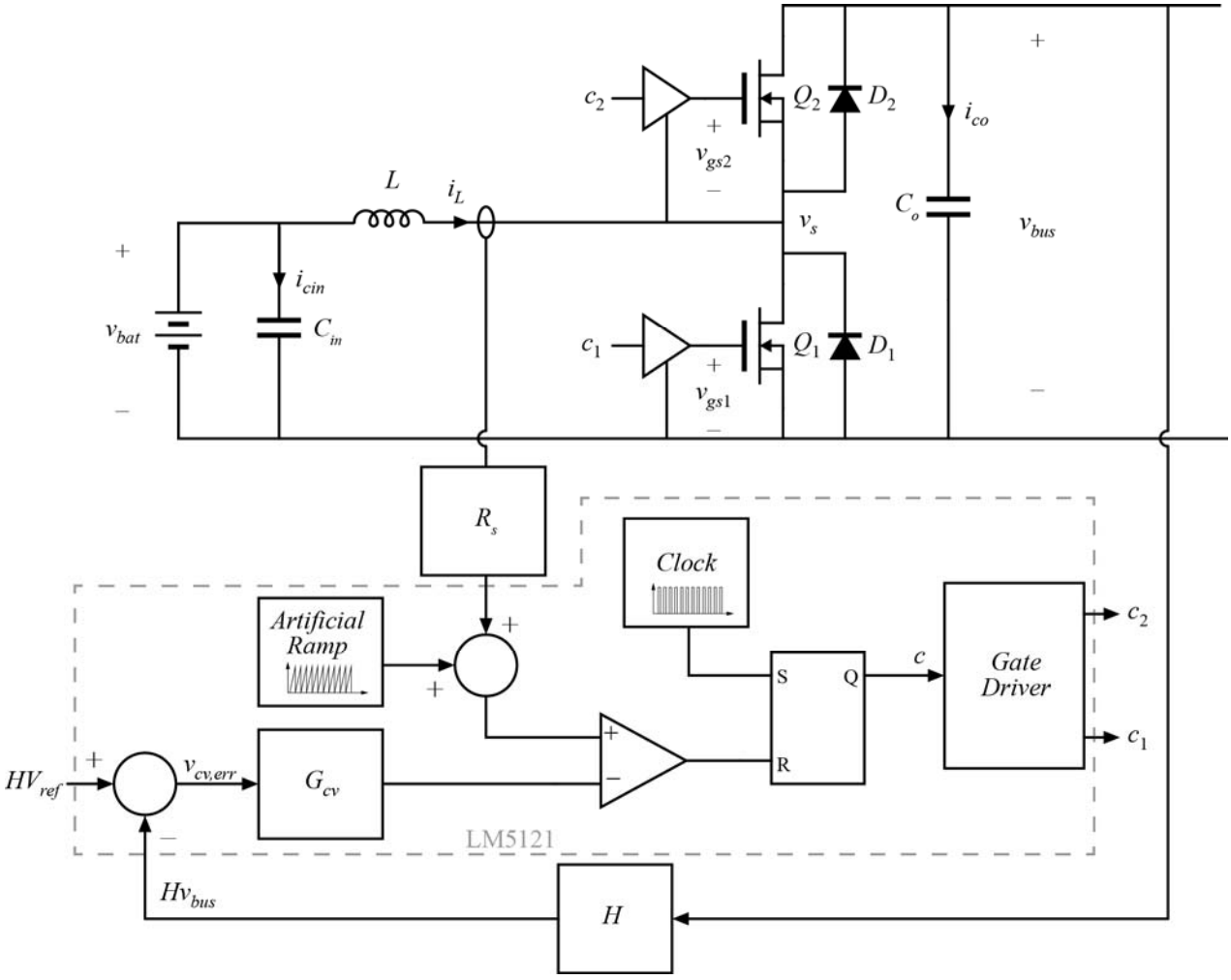

Figure 1: Nominal system diagram for drivetrain boost converter and inverter

Fig. 1 shows the nominal system diagram for the closed-loop DC-DC boost converter built in experiments 3 and 4, as well as a base design for the drive train inverter and central control circuitry. In this prelab, you are to modify the system beyond the nominal case in order to improve the performance of the system. Improvements should be motivated by one or more of the following metrics

- Improved efficiency / Decreased loss
- Improved dynamic performance
- Expanded operational limits
- Increased operator or circuit safety
- Improved robustness
- Reduced cost
- Reduced size
- Added Functionality
- Other areas (with instructor permission)

These improvements, or combination of improvements, that you propose to make to the system should constitute a significant redesign of one or more aspects of the system. Both several smaller changes and fewer, more significant alterations are acceptable. A small, non-exhaustive list of examples of improvements to consider is given at the end of this prelab assignment.

For this prelab assignment, describe all alterations you propose to make to the system, and give any relevant analysis to argue the improvement you expect to see in system performance or characteristics. Turn in

a *short* writeup with any relevant calculations attached. Be specific, making clear exactly how and why you plan to change the system; give part numbers and relevant parameters of any new or altered components and include diagrams of any additional circuitry added to the system of Fig. 1.

Though there is no specific quantity which constitutes sufficient alterations to the system, your grade in experiment 4 will rely on your proposed changes being significant enough to warrant additional design work. If you have any questions on whether your proposed changes meet this qualification, speak with the instructor directly.

Some Possible System Alterations:

- Redesign converter for different switching frequency
- Redesign magnetics
  - Change allowable ripple value
  - Improve losses through more in-depth design
- Select new devices (e.g. power semiconductors, control ICs, passives)
  - Minimum loss devices
  - Minimum cost devices
  - Increased voltage or current handling capability
- Redesign boost converter control network
  - Redesign compensator transfer functions
  - Change controller architecture entirely
- Change gate drive implementation
- Change DC-DC converter topology
- Reduce component cost while maintaining comparable performance
- Alter components to allow larger output voltage range
- Design converter to produce auxiliary supply
- --- Many more ----