

RESULTS/CONCLUSION

Electrical Team

- Full bridge design provides more accurate measurements
- Successful design and implementation of circuit that measures RPM (revolutions per min.)

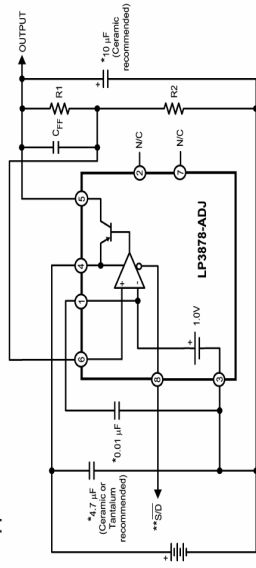
- Wireless transmission successful

Mechanical Team

- Design system of bridges
- Developed crank angle measurement method
- Measured strain for each bridge, pedal, and chain ring
- Obtained coefficients that are used in algorithm to calculate torque for 8 different angles



Basic Application Circuit



IPRO 324

Power Measurement for Road Bicycles

"No strain, no gain..."



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PROBLEM STATEMENT

The goal of this IPRO is to develop a system that measures the applied torque at the crankset. This will then be combined with advanced signal processing providing the user with information on mechanical power input.

BACKGROUND

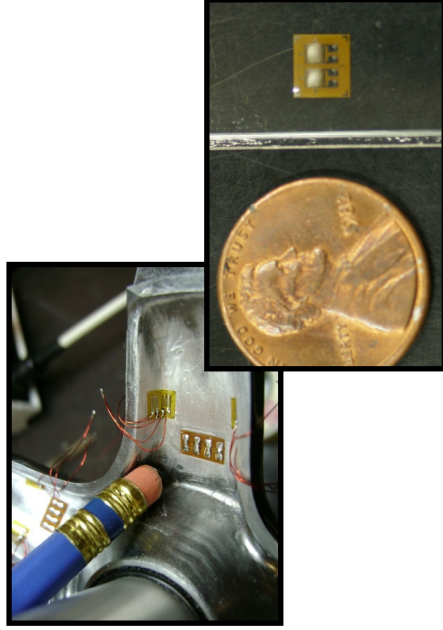
Current available systems to measure mechanical power output:

- Crankset (strain in crankset)
- Free hub (strain in rear wheel)
- Chain (vibration and speed of chain)
- Opposing force (gravity, drag, acceleration, & wind velocity)

Strain (material deformation) is used to calculate torque which can be used to find power

Survey Results from Cycling Community (100+)

- 63% preferred crankset system
- 45% do not want to replace bike parts
- 50% said cost was a major factor when choosing a power meter



OBJECTIVE

- Determine optimal configuration of strain gages
- Develop an electronic unit for processing the strain gages' signal
- Package the system
- Minimize cost



GARMIN EDGE 705

METHODOLOGY

Electrical Team

- Resume work and troubleshooting (IPRO F'09)
- Develop component circuits
 - Strain gage amplification
 - ANT+ wireless communication
 - RPM & crank angle monitoring
- Final product is a combination of circuits
- Final product will use an algorithm that processes strain gage data into torque
- Results can then be wirelessly transmitted to a cycling computer (Garmin Edge 705)

Mechanical Team

- Design system of strain gages
- Apply 4 strain gage bridges to apparatus
- Determine algorithm to relate strain to the applied torque at a given angle

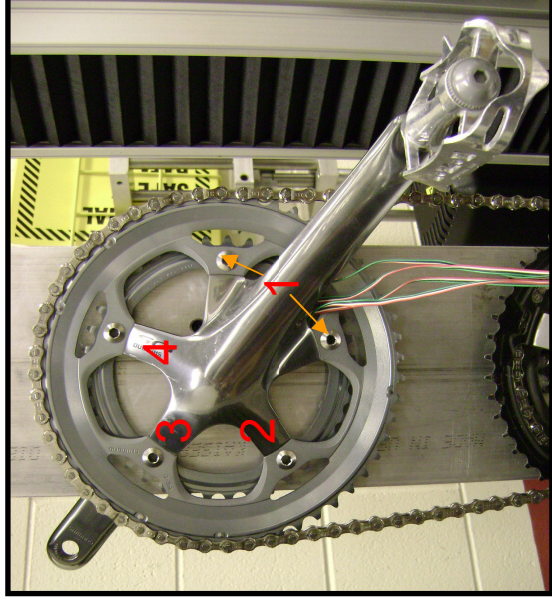
OBSTACLES

Electrical Team

- Long connecting wires reduce signal quality
- Need for switches on each bridge when using only one amplifier
- Output impedance for the op-amp must be very low when using ADC
- Problems with microcontroller operations

Mechanical Team

- Finding discrete location for strain gages as well as the complete system
- Application of small strain gages (<0.25 in)
- Calculating crank angle
- Creating algorithm to measure power output



PLACEMENT OF BRIDGES ON CRANKSET