2016

Formula Hybrid at VCU: Epicyclic Power Distribution System

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Sponsor: Sternheimer Foundation Award Winners

MECHANICAL AND NUCLEAR

Formula Hybrid at VCU

Epicyclic Power Distribution System

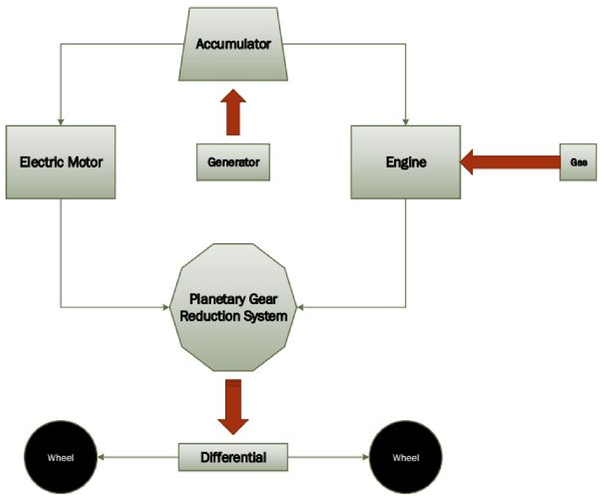
CAPSTONE DESIGN EXPO 2016

Purpose & System Flow

What is an Epicyclic Power Distribution System?

A system which combines two independent power inputs from both an electric motor and an internal combustion engine.

- ❏ Designed for the Formula Hybrid race car at VCU
- ❏ First and only Formula Hybrid team in Virginia
- ❏ Opportunities for future cross-discipline integration
- ❏ Focus on reduction of vehicle emissions



Torque and Power Inputs

- ❏ Lynch LEM170-96 Electric motor
- ❏ Yamaha YZ250F | 250cc Motorcycle engine
- ❏ Both motors operate independently & simultaneously, as well as increase the efficiency of the engine in <u>both</u> hybrid and all-electric modes

Design

Gears

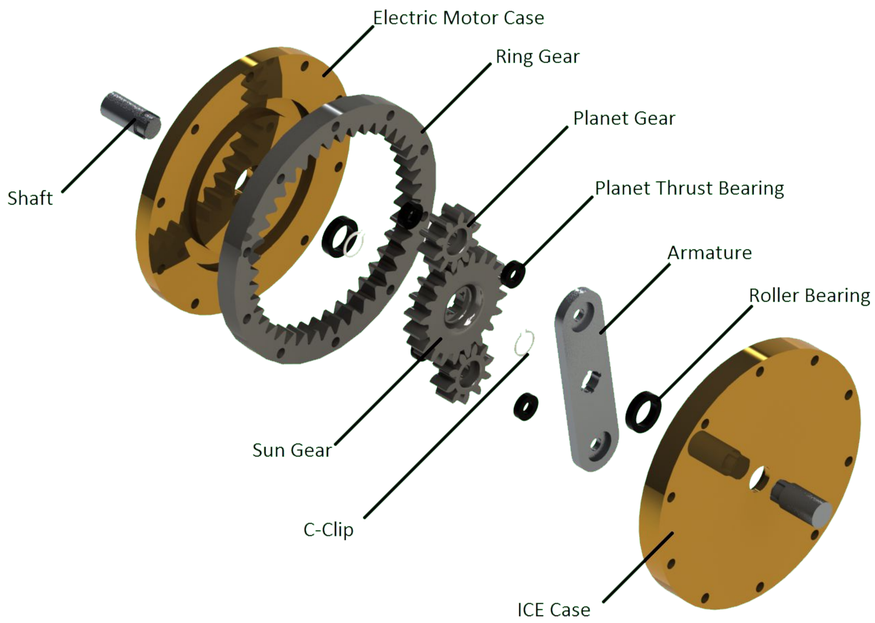
- ❏ Involute Profile
  - ❏ Low Friction
  - ❏ Easy to manufacture
  - ❏ Constant pressure angle
  - ❏ High strength steel alloy

Bearings

- ❏ Thrust Bearings
- ❏ Roller Bearings

Planet Thrust Bearing

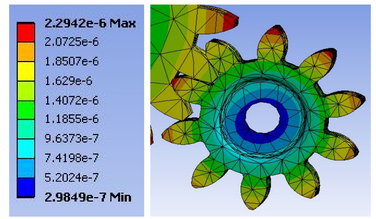
Roller Bearing



Analysis

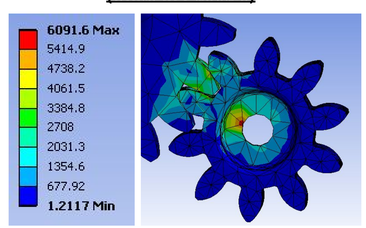
Total Deformation

(Units in mm)



Equivalent (Von-Mises) Stress

(Units in Pascals)



Operating torque from electric motor: 12 N-m

- ❏ Total deformation and stress of input and output gears are well within operational limits

Future Considerations

Future Formula Hybrid teams will need to consider:

- ❏ Clutch System
- ❏ Engine Management
- ❏ Chassis Improvements
- ❏ Manufacturability
- ❏ Procurement