



**Autonomous Vehicle Simulation (AVS) Laboratory,
University of Colorado**

Basilisk Technical Memorandum

Document ID: Basilisk-extForceTorque

**MODULE TO APPLY A PRESCRIBED FORCE OR TORQUE ONTO A RIGID
BODY**

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Status: First Version
Scope/Contents
This module allows an external force and/or torque about a body fixed point B to be prescribed through either direct input from python, or through a message.

Rev:	Change Description	By
v1.0	Initial document	H. Schaub

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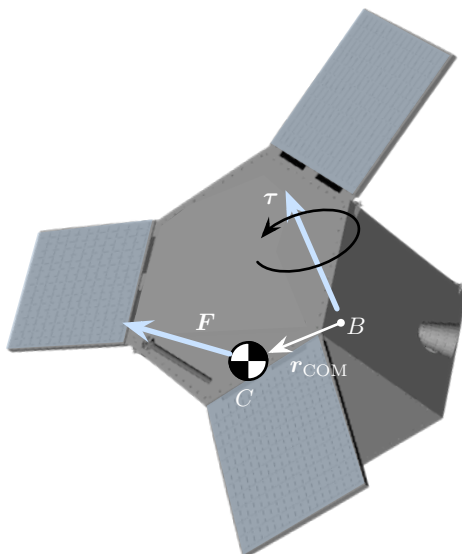


Fig. 1: Illustration of Force and Torque acting on a rigid body

1 Introduction

This module allows a general force \mathbf{F} or torque $\boldsymbol{\tau}$ to be applied onto a rigid body. The force is the net external force acting through the center of mass, and can be specified in inertial \mathcal{N} or body-frame \mathcal{B} coordinates. The torque is taken about the body-fixed point B , and the vector components are given in the body frame \mathcal{B} .

2 Specifying the Forces/Torques through Messages

The module reads in a message that specifies an external force or external torque. Not that there essentially are 3 input options. The torque vector is always provided in body frame vector components.

The external force can be provided as a vector with respect to the inertial or body frame. **Note, it is possible to set both types, but this applies 2 separate vectors to the rigid body.**

2.1 External Torque

The torque message ${}^B\boldsymbol{\tau}_B$ is stored in a message with default name

`extTorquePntB_B_cmds`

stored in the module variable

`cmdTorqueInMsgName`

2.2 External Force in \mathcal{N} Inertial Frame Vector Components

The inertial force message ${}^N\boldsymbol{F}$ is stored in a message with default name

`extForce_N_cmds`

stored in the module variable

`cmdForceInertialInMsgName`

2.3 External Force in \mathcal{B} Body Frame Vector Components

The inertial force message ${}^B\boldsymbol{F}$ is stored in a message with default name

`extForce_B_cmds`

stored in the module variable

`cmdForceBodyInMsgName`

3 Module Parameters

The forces and torque vectors can also be set directly from python. These values are added up in addition of the messages set above.

3.1 `extTorquePntB_B` Parameter

This vector sets the external torque, about point B , in \mathcal{B} body-frame vector components.

3.2 `extForce_N` Parameter

This vector sets the external force \boldsymbol{F} in \mathcal{N} inertial-frame vector components.

3.3 `extForce_B` Parameter

This vector sets the external force \boldsymbol{F} in \mathcal{B} inertial-frame vector components.