



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

Basilisk Technical Memorandum

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GUIDANCE MODULE TO PERFORM AN INERTIALLY FIXED POINTING

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Status: Version 1.2
Scope/Contents
Generate the reference attitude trajectory for a general 3D inertial pointing. A corrected body frame will align with the desired reference frame.

Rev:	Change Description	By
Draft	initial copy	M. Cols
1.1	Updated template to BSK from AVS	D. Burder
1.2	Added test result discussion and user guide section	H. Schaub

Contents

1 Model Description

This technical note discusses the guidance mathematics to compute a reference frame \mathcal{R} that is aligned with an inertially fixed frame \mathcal{R}_0 , as shown in Figure ??.

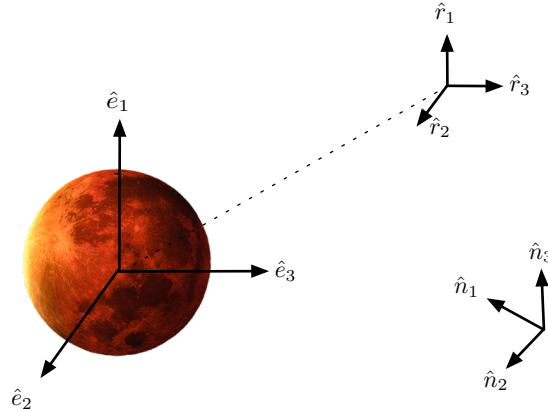


Fig. 1: Illustration of the input inertially fixed frame $\mathcal{R}_0 : \{\hat{e}_1, \hat{e}_2, \hat{e}_3\}$, the generated reference frame $\mathcal{R} : \{\hat{r}_1, \hat{r}_2, \hat{r}_3\}$ and the inertial frame $\mathcal{N} : \{\hat{n}_1, \hat{n}_2, \hat{n}_3\}$

1.1 Reference Frame Generation

The module requires the desired reference orientation in terms of the MRP set σ_{R_0N} . This input is only set once and does not have to be changed. Let us designate \mathcal{R} as the output generated reference frame. Since the fixed-pointing is inertial:

$$\sigma_{RN} = \sigma_{R_0N} \quad (1)$$

$$\omega_{RN} = \dot{\omega}_{RN} = 0 \quad (2)$$

1.2 Module Input and Output

Table ?? shows the input Configuration Data of the module Inertial 3D Point.

Table 1: Input Configuration Data

Name	Type	Length	Description
$\sigma_{R_0/N}$	double []	3	MRP attitude set of the desired reference frame with respect to the inertial frame .

Table ?? shows the Attitude Reference output message of the module Inertial 3D Point.

2 Module Functions

The FSW module purpose is to:

- **Set a desired inertial orientation:** The reference frame orientation is specified through an MRP set.

Table 2: Output Attitude Reference Message

Name	Type	Length	Description
$\sigma_{R/N}$	double []	3	MRP attitude set of the reference frame with respect to the inertial frame.
$\mathcal{N}\omega_{R/N}$	double []	3	Angular rate vector of the reference frame with respect to the inertial expressed in inertial frame components.
$\mathcal{N}\dot{\omega}_{R/N}$	double []	3	Angular acceleration vector of the reference frame with respect to the inertial expressed in inertial frame components.

- **Zero the rate information:** The reference frame angular rates and accelerations are zeroed as this reference frame is inertially fixed.

3 Module Assumptions and Limitations

This simple module has no assumptions or limitations.

4 Test Description and Success Criteria

The unit test verifies that the module output guidance message vectors match expected values. The simulation sets up the module to output a fixed MRP set.

5 Test Parameters

Table 3: Error tolerance for each test.

Output Value Tested	Tolerated Error
sigma_RN	1e-12
omega_RN_N	1e-12
domega_RN_N	1e-12

6 Test Results

All of the tests passed:

Table 4: Test results

Check	Pass/Fail
1	PASSED

7 User Guide

- `sigma_RON` – The desired reference frame orientation must be specified by setting this parameter.