

# Satellite Attitude Animation and Simulation (SAAS)

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## Abstract

This is a documentation for the Satellite Attitude Animation and Simulation (SAAS) program written in MATLAB. This documentation covers the

**NOTE:** Some of the concepts here require extensive literature reading, serve this either as a starting point or collection of knowledge, as I'll do my best to include materials that are helpful during my studies.

***Index Terms*** — Orbit propagation, perturbation, Legendre polynomials, gravitational potential, satellite

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```
TITLE INPUT_SIM.txt

MODE simulation
MODEL
    NAME      FS9
    CG         [2.7717896e+00  1.8211494e+01  8.9988957e+02]
    FILE       'model/fs9_SADA.stl'
END
ENV
    BETA_ANGLE 15
END
COMPONENT
    STR1       [474.918, 479.593, 931.902]
               [473.641, 478.316, 934.298]
    STR2       [-486.347, 537.236, 332.014]
               [-443.741, 494.732, 411.878]
    USER      [-0.388, -0.198, -0.01]
               [0, 0, 0]
END
OPTION
    STR_VIEW   0
END
VALUE
    DESIGN     1
    FRAME      'ECI'
    QUAT_DESIGN [0, -240, 50]
    QUAT_SINGLE []
    QUAT_PROF   'QUAT_PROFILE.txt'
END
```

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Table I: Simulation Input Data

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```

TITLE INPUT_PROP.txt

MODE propagation
MODEL
    NAME      FS9
    CG        [2.7717896e+00  1.8211494e+01  8.9988957e+02]
    CAD FILE   'model/fs9_SADA.stl'
END
ENV
    BETA_ANGLE 15
END
COMPONENT
    STR1      [474.918, 479.593, 931.902]
              [473.641, 478.316, 934.298]
    STR2      [-486.347, 537.236, 332.014]
              [-443.741, 494.732, 411.878]
    USER      [-0.388, -0.198, -0.01]
              [0, 0, 0]
END
OPTION
    STR_VIEW   0
END
TREND
    QUAT       'fs7t_SE_SAAS_Q_2024050090000_2024051090000_A.txt'
    ECI        'fs7t_SE_SAAS_ECI_2024050090000_2024051090000_A.txt'
    LLA        'fs7t_SE_SAAS_LATLON_2024050090000_2024051090000_A.txt'
    ECLIPSE    'fs7t_SE_SAAS_Eclipse_2024050090000_2024051090000_A.txt'
    SUN        'fs7t_SE_SAAS_SUN_2024050090000_2024051090000_A.txt'
END

```

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Table II: Propagation Input Data

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```

>> init

|-MODE:      simulation
|-MODEL:
|-   NAME:    FS9
|-   CG:      [2.7717896 18.211494 899.88957]
|-   FILE:    model/fs9_SADA.stl
|-   CAD:
|-           vert: [52958x3 double]
|-           faces: [110808x3 double]

|-ENV:
|-   BETA_ANGLE: 0.261799387799149

|-COMPONENT:
|-   STR1: [474.918 479.593 931.902;473.641 478.316 934.298]
|-   STR2: [-486.347 537.236 332.014;-443.741 494.732 411.878]
|-   USER: [-0.388 -0.198 -0.01;0 0 0]

|-OPTION:
|-   STR_VIEW: 0

|-VALUE:
|-   DESIGN_opt: 1
|-   FRAME:      ECI
|-   QUAT_DESIGN: [0 -240 50]
|-   QUAT_SINGLE: []
|-   QUAT_PROF:  []

Orbit SA energy percentage: 48.34%

Rotation Simulation Completed!

```

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Table III: Terminal Simulation Data Display

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```

>> init

|MODE:      propagation
|MODEL:
|  NAME:    FS9
|  CG:      [2.7717896 18.211494 899.88957]
|  FILE:    model/fs9_SADA.stl
|  CAD:
|    vert:   [52958x3 double]
|    faces:  [110808x3 double]

|ENV:
|  BETA_ANGLE: 0.261799387799149

|COMPONENT:
|  STR1: [474.918 479.593 931.902;473.641 478.316 934.298]
|  STR2: [-486.347 537.236 332.014;-443.741 494.732 411.878]
|  USER: [-0.388 -0.198 -0.01;0 0 0]

|OPTION:
|  STR_VIEW: 0

|TREND:
|  QUAT: [89x4 double]
|  ECI: [1350x4 double]
|  LLA: [1350x2 double]
|  ECLI: [1350x1 double]
|  SUN: [1350x3 double]
|  DATE: [1350x1 datetime]

Trending File Propagation Completed!

```

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Table IV: Terminal Simulation Data Display