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## README - 4-Star Matching Algorithm: Preprocessing

Guidance, Navigation and Controls Subsystem

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### sm\_constants\_4\_str\_mtch.m

**Code Type:** MATLAB - Script

**Code author:** KT Prajwal Prathiksh

**Created on:** 26/04/2020

**Last modified:** -/-/-

**Reviewed by:** NOT YET REVIEWED!

#### Description:

This script generates all the constants required for 4-Star Matching Algorithm as well as the Reference Star Catalogue. It also saves the values of the constants and catalogue.

The constants are as follows:

1. **Focal\_Length:** (Float) The focal length of the optics system. Units in *mm*
2. **sm\_M\_EPS:** (Float) The machine epsilon of the platform where the algorithm will be executed
3. **n\_rw\_GC:** (Integer) The number of stars (= number of rows) in the Guide Star Catalogue
4. **n\_rw\_RC:** (Integer) The number of star-pairs (= number of rows) in the Reference Star Catalogue
5. **sm\_DELTA:** (Float) The  $\delta$  constant that determines the tolerance of the size window when searching for an angular distance value in the Reference Star Catalogue
6. **sm\_M:** (Float) The slope of the Z-vector line
7. **sm\_Q:** (Float) The y-intercept of the Z-vector line

**Formula & References:** –

#### Input parameters:

1. **write\_csv:** (Boolean) If true, saves the Reference Star Catalogue as a csv file

#### Output:

1. Writes constants in `./Star_Matching/4_Star_Matching/Preprocessing/sm_constants_4_str_mtch.mat` directory
2. Writes Reference Star Catalogue in `./Star_Matching/4_Star_Matching/Preprocessing/Reference_Star_Catalogue_4_str_mtch.csv` directory

## **sm\_RF\_SC\_4\_str\_mtch.m**

**Code Type:** MATLAB - Script

**Code author:** KT Prajwal Prathiksh

**Created on:** 26/04/2020

**Last modified:** -/-/—

**Reviewed by:** NOT YET REVIEWED!

**Description:**

This script generates the Reference Star Catalogue as required by 4-Star Matching Algorithm, which has the following columns:

1. **SSP\_ID\_1** - The SSP-ID of  $i^{th}$  star
2. **SSP\_ID\_2** - The SSP-ID of  $j^{th}$  star
3. **K\_Vec** - The K-Vector value determined uniquely using the dot product of the Cartesian unit vector corresponding to the  $i^{th}$  and  $j^{th}$  star ( $i \neq j, \forall i, j$ )

**Note:** This script should be run only by **sm\_constants\_4\_str\_mtch!** The script will throw an error if run by itself!

**Formula & References:** –

**Input parameters:** –

**Output:**

1. Writes Reference Star Catalogue on `./Star_Matching/4_Star_Matching/Preprocessing/Reference_Star_Catalogue_4_str_mtch.csv` directory

## **sm\_gnrt\_K\_Vec.m**

**Code Type:** MATLAB - Function

**Code author:** KT Prajwal Prathiksh

**Created on:** 26/04/2020

**Last modified:** -/-/—

**Reviewed by:** NOT YET REVIEWED!

**Description:**

This function generates the K-Vector for a given array.

**Formula & References:**

Reference: The original k-vector searching technique - Mortari, D. Neta, Beny. (2000). *k-Vector Range Searching Technique*. 105.

**Input parameters:**

1. **c\_y** : ( (N, 1) - Matrix ) - The array for which K-vector has to be generated
2. **sm\_M\_EPS** : (Float) - The machine epsilon of the platform where the algorithm will be executed
3. **is\_sorted** : (boolean) - If true, implies the array is sorted

**Output:**

1. **K\_Vec**: ( (N, 1) - Matrix ) - The K-vector of the given array

2. **sm\_M** : (Float) - The slope of the Z-vector line
3. **sm\_Q** : (Float) - The y-intercept of the Z-vector line
4. **I\_Vec** : ( (N, 1) - Matrix ) - The integer vector associated with sorting