The function hgm.MLEso3 constructs the MLE for the Fisher distribution on SO(3).

Description

The function hgm.MLEso3 constructs the maximum likelihood estimator (MLE) for the Fisher distribution on SO(3) given the sample mean of a data set as input.

Usage

```
hgm.MLEso3(Y,X = c(0.01, 0.005, 0),
           ord=19,method="H-BFGS")
```

Arguments

`Y`	A 3 by 3 matrix of the sample mean.
`X`	A 1 by 3 vector giving the (optional) start point of the optimization algoritm. See Details section below.
`ord`	The order at which to truncate the series expansion for the normalising constant. This is used to calculate the starting values of the normalising constant and its gradient. The higher the order the more accurate the result. However, the computational cost increases.
`method`	The optimization algorthim used. The options are 'H-BFGS', using the BFGS algorthim in conjunction with the holonomic gradient method, 'H-Newton', the holonomic Newton method, and 'Asymptotic', which utilises the formula for singular values close to unity.

Details

The MLE is defined as the argmax of the function

$$l(X) = d\_1*X\_1 + d\_2*X\_2 + d\_3*X\_3 - log(c(X)).$$

Here X is the 1 by 3 vector of singular values of the matrix parameter, d is the 1 by 3 vector of sign preserving singular values of the sample mean and c(X) is the normalising constant.

Value

A list with the components:

`parameter`	The maximum likelihood estimator for the 3 by 3 parameter matrix Theta.
`value`	The maximum log-likelihood value.

Author(s)

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References

Michael F. Adamer, Andras C. Lorincz, Anna-Laura Sattelberger and Bernd Sturmfels: Algebraic Analysis of Rotation Data. ArXiv preprint 1912.00396, 2019, https://arxiv.org/abs/1912.00396

Examples

```
## ========================================================================
## Example 1. Computing the MLE for the Asteroid Data of Sei et al.
## ========================================================================
Y <- matrix(c(0.074,0.018,-0.001,0.012,0.003,0.949,0.016,-0.074,0.02),nrow=3)
hgm.MLEso3(Y)
```