### numrec

miscellaneous "numerical" routines

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## 1.1 Outline

This file contains various miscellaneous "numerical" routines as described below.

## 1.2 gi00ab

1. This routine assigns the Fourier mode labels that converts a double-sum into a single sum; i.e., the  $m_j$  and  $n_j$  are assigned where

$$f(\theta,\zeta) = \sum_{n=0}^{N} f_{0,n} \cos(-n N_P \zeta) + \sum_{m=1}^{M} \sum_{n=-N}^{N} f_{m,n} \cos(m\theta - n N_P \zeta)$$
(1)

$$= \sum_{j} f_{j} \cos(m_{j}\theta - n_{j}\zeta), \tag{2}$$

where  $N \equiv \text{Ntor}$  and  $M \equiv \text{Mpol}$  are given on input, and  $N_P \equiv \text{Nfp}$  is the field periodicity.

### 1.3 tfft

- 1. This constructs the "forward" Fourier transform.
- 2. Given a set of data,  $(f_i, g_i)$  for  $i = 1, ..., N_\theta N_\zeta$ , on a regular two-dimensional angle grid, where  $\theta_j = 2\pi j/N_\theta$  for  $j = 0, N_\theta 1$ , and  $\zeta_k = 2\pi k/N_\zeta$  for  $k = 0, N_\zeta 1$ . The "packing" is governed by  $i = 1 + j + kN_\theta$ . The "discrete" resolution is  $N_\theta \equiv \text{Nt}$ ,  $N_\zeta \equiv \text{Nz}$  and  $\text{Ntz} = \text{Nt} \times \text{Nz}$ , which are set in preset.
- 3. The Fourier harmonics consistent with Eqn.(2) are constructed. The mode identification labels appearing in Eqn.(2) are  $m_j \equiv \text{im}(j)$  and  $n_j \equiv \text{in}(j)$ , which are set in global via a call to gi00ab.

# 1.4 invfft

- 1. Given the Fourier harmonics, the data on a regular angular grid are constructed.
- 2. This is the inverse routine to tfft.

## 1.5 gauleg

- 1. Compute Gaussian integration weights and abscissae.
- 2. From Numerical Recipes.

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SPEC subroutines;