

Appendix B

EV stellar evolution

Construction of a ZAMS can be done using a variety of metallicities. In this code the sub-directory `../metals` contains sub-sub-directories for $Z=0.0001$, 0.0003 , 0.001 , 0.004 , 0.01 , 0.02 , 0.03 . These have the physical data file (f20, alias fort.20) and the $Z = 0.02$ directory contains a model data file (f14, alias fort.14) for an initial ZAMS model of $0.1 M_{\text{sun}}$. The present fort.18 alias run01/f18 will do for any metallicity, since the information taken from it is negligible in the case of ZAMSs. Before running an evolution at various set of parameters one has to create a ZAMS model in a wide range of masses.

Below are the steps to create a ZAMS at different metallicity, Z :

1) $Z = 0.02$, and $m = 0.1$ to $200 M_{\text{sun}}$

```
rm -f fort.1 fort.2 fort.3 fort.4 fort.8 fort.9 fort.10 fort.13 fort.14
rm -f fort.15 fort.17 fort.26 fort.29 fort.51
cp run01/f22 fort.22
cp run01/f23 fort.23
cp run01/g18 fort.18
cp run01/g19 fort.19
cp metals/z02/f20 fort.20
cp metals/z02/f14 fort.14
make
./ev
cp fort.1 fort.18
cp fort.15 fort.16
cp fort.1 run01/f1.z02      # for backup
cp fort.9 run01/f9.z02     # for backup
cp fort.15 run01/f15.z02   # for backup
cp fort.29 run01/f19.z02   # for backup
cp fort.29 fort.19
```

2) $Z = 0.001$, and $m = 0.1$ to $200 M_{\text{sun}}$

```
rm -f fort.1 fort.2 fort.3 fort.4 fort.8 fort.9 fort.10 fort.13 fort.14
rm -f fort.15 fort.17 fort.26 fort.29 fort.51
cp run01/f22 fort.22
cp run01/f23 fort.23
cp run01/g18 fort.18
cp run01/g19 fort.19
cp metals/z001/f20 fort.20
cp metals/z02/f14 fort.14
make
./ev
cp fort.1 fort.18
```

```

cp fort.15 fort.16
cp fort.1 run01/f1.z001          # for backup
cp fort.9 run01/f9.z001         # for backup
cp fort.15 run01/f15.z001      # for backup
cp fort.29 run01/f19.z001     # for backup
cp fort.29 fort.19

```

3) $Z = 0.03$, and $m = 0.1$ to $200M_{\text{sun}}$

```

rm -f fort.1 fort.2 fort.3 fort.4 fort.8 fort.9 fort.10 fort.13 fort.14
rm -f fort.15 fort.17 fort.26 fort.29 fort.51
cp run01/f22 fort.22
cp run01/f23 fort.23
cp run01/g18 fort.18
cp run01/g19 fort.19
cp metals/z03/f20 fort.20
cp metals/z02/f14 fort.14
make
./ev
cp fort.1 fort.18
cp fort.15 fort.16
cp fort.1 run01/f1.z03          # for backup
cp fort.9 run01/f9.z03         # for backup
cp fort.15 run01/f15.z03      # for backup
cp fort.29 run01/f19.z03     # for backup
cp fort.29 fort.19

```

The next steps are for running other jobs in the evolution process. In this work we used the configurations files under job named run04 which evolves star with rotation, dynamo activity, mass loss by dynamo-driven stellar wind and magnetic braking.

```

rm -f fort.1 fort.2 fort.3 fort.4 fort.8 fort.9 fort.10 fort.13 fort.14
rm -f fort.15 fort.17 fort.26 fort.29 fort.51
cp run04/f22-deltasco fort.22          # configuration file
cp run04/af23-deltasco fort.23        # configuration file

```

The initial stellar mass and rotation can be changed in file fort.23 and mass loss can be changed in file fort.22. The content of files fort.23 and fort.22 are as follows: