ER-flow Application Description Template

Application Name *(will be used as workflow name in the repo)*:
FRANEC/BaSTI simulations

Application domain *(choose one existing in the repo, otherwise will be created)*:
Astrophysics

Brief description of application *(explain implemented function, inputs, outputs, usage)*:
FRANEC is a state-of-art, numerical code for stellar astrophysics, This code is perfectly suited for computing the evolution of a star on the basis of a number of different physical inputs and parameters. Parameters are listed in one input file. A single run of FRANEC produces one synthetic model (SM). To produce an isochrone, for a given chemical composition, through a FIR (Full Isochrone Run), it is necessary to execute a large number of SMRs (SM runs) varying the initial mass of the stellar models. Once these evolutionary tracks and isochrones (as well as additional data describing the simulated stellar structures) are computed, they can be distributed in datasets over different sites.
The simulations of stellar models produce simulation output files with a set of associated metadata. Such metadata are linked to all parameters concerning the numerical evolutionary code. In this way it is possible to store and easily search and retrieve the obtained data by many set of stellar simulations, and also get access to a huge amount of homogeneous data such as tracks and isochrones computed by using FRANEC.
The **BaSTI** (Bag of Stellar Tracks and Isochrones) database is a theoretical astrophysical catalogue that collects fundamental data sets involving stars formation and evolution.
The BaSTI relational database is a suite of stellar evolution tracks, isochrones, luminosity functions and complementary codes to study the properties of resolved and unresolved stellar populations with an arbitrary SFH (Star Formation History).
All stellar model simulations and their characterizing parameters, the produced output files and their metadata and the relationships (links) between them are stored and maintained in BaSTI.
BaSTI allows in this way to archive and publish the data of many stellar evolution simulations; it also offers to the scientific community the possibility of reusing a large number of stellar model computations.
According to the planned evolution, the BaSTI database will be automatically updated when new simulations are available. BaSTI, moreover, could be updated on request. When an astronomer requests some data that are not available in the database, a service will allow to submit a FIR to update the database with the requested data. The service is moderated, i.e. the content managers decide if the requested data should be computed or not according to their scientific relevance/interest.

data:
input data format: Ascii
input data value range: Mass: 0.5Mo - 10Mo; Z=0.0001 - 0.004; Y=0.20 - 0.35 additional secondary parameters such as mass loss efficiency, mixing length parameters can be also changed according to the user requirements.
output data format: Ascii
output data value range: in the output a complete description of the structural and evolutionary properties of the computed stellar model is provided so the range depends on the considered physical quantity of interest.
sample data (link): http://albione.oa-teramo.inaf.it/
application (link): ----

documentation (link): http://albione.oa-teramo.inaf.it/
publication (link): in the previously quoted link there is a complete list of the papers where the BaSTI results and evolutionary computations are discussed.

Execution environment

DCI: (computing, data, VO, etc): astro VO; any other VO which provides support to the A&A HUC.

middleware: gLite workflow system: WS-PGRADE

Execution characteristics

data size (per unit, typical number of units):

input	temporary	output
about 3.5 MB		it depends on the performed computation but lower than 3-4GB

processing time (per unit): 1 single job lasts typically 4-5 hours. A new isochrone requires the execution of a large number of FRANEC runs; this number typically is of the order of 40 but each individual run, for a given initial stellar mass, is based on the computation of about 4000 distinct models. The computation of a new isochrone may last a few weeks on a workstation.

memory usage: 2 GB (on each WN) disk usage: >10 GB (80 MB per 1 CPU)

Target users

Community: astrophysicists interested to study stars and both resolved and unresolved stellar populations.

Projects (link):

number of users:

user type: Researchers/PhD Students developer: Yes end-user: Yes

Usage scenario for workflow in the ER-FLOW *(how workflow will be reused, meta-workflow, how expected to contribute to project indicators, etc.)*.

The BaSTI/FRANEC workflow has a typical modular architecture; it is easy to identify its modules that can be reused to build other workflows. Modules can be identified on the basis of the function(s) they provide: 1) retrieval of the simulation files obtained (output) through past simulation runs[1]; 2) retrieval of a synthetic model simulation[2]; 3) new simulation of a synthetic model[3]; 4) ingestion of a new synthetic model[4]; 5) post-processing analysis[5].

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[1] The end user specifies a set of metadata. Metadata of each simulation output file are compared against metadata provided by end user. At the first match occurrence, the corresponding output file is returned.

[2] Given a simulation output file, its associated metadata are used to retrieve and return to the end user the synthetic model simulation that originated the output file thanks to the relationship established between such metadata and the input parameters file.

[3] A new simulation of a synthetic model is performed. Skilled end users have to choose the synthetic model to simulate and the set of values for initial parameters. The scientific relevance of the new simulation has to be verified/certified by the Content Manager of the BaSTI database. If not relevant, the new simulation is rejected. The resulting output file is stored in BaSTI together with its related metadata set up by the skilled end user.

[4] New synthetic models might be proposed by skilled end users to be inserted in BaSTI. The scientific relevance of the new synthetic model has to be verified/certified by the Content Manager of the BaSTI database. If not relevant, the new synthetic model is rejected.

[5] Final products resulting from synthetic model simulations and contained in the simulation output files might be used to perform specific post-processing analysis by running software packages provided by end users or third-party contributed. The necessary precondition is the deployment of such software packages on the adopted DCI.

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