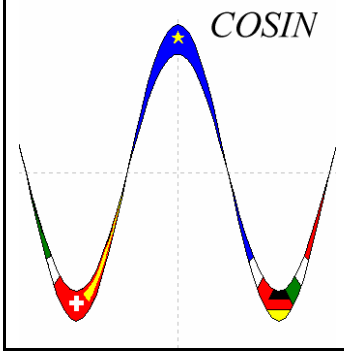

COSIN

IST–2001-33555

Coevolution and Self-Organization in Dynamical Networks

http://www.cosin.org

Web Site and Web interface

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Abstract

In this report we present the main features of the project Website and the Web interface that has been realised for a presentation and a first analysis of graphs. To discover all the features and to download documents or software the reader might find convenient to connect to http://www.cosin.org

WWW Site

The WWW is one of the easiest way to disseminate information in an economic and yet effective way. Being also the subject of study of this project, it has been natural to devote a large effort of the dissemination actions in the building of a Web site that could help both participants and external people.

Figure 1: The home page of the project at http://ww.cosin.org

Home page

The COSIN home page has been structured in several thematic subsections in order to facilitate the surfing of the site.

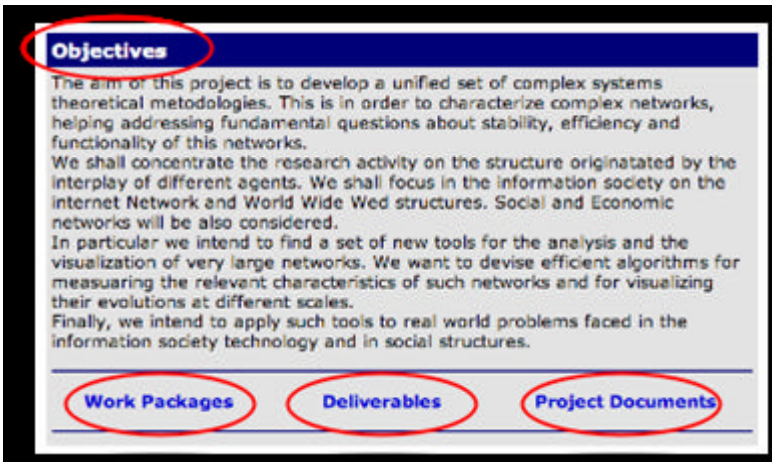
At the top of the page the seven *nodes* that have agreed to the COSIN project are showed, clicking on a node will redirect to the homepage of the institution.

The middle of the page is dedicated to a brief *description* of the COSIN project and to the *news* concerning the world of statistical physics and complex networks.

Figure 2: The main links at http://ww.cosin.org

At the left of the page an intuitive column bar helps to easily jump between:

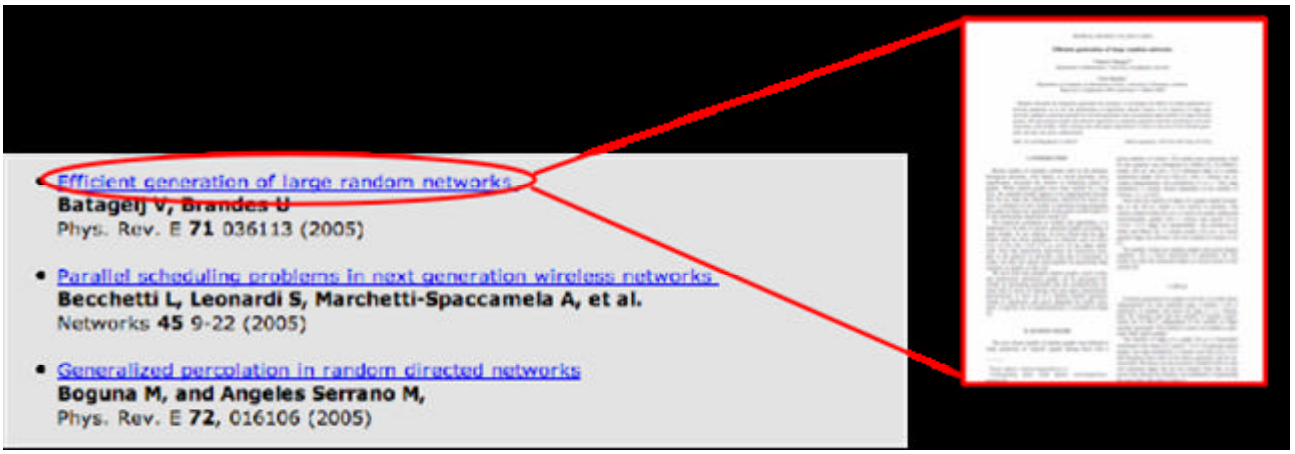
- **About COSIN:** The aim and the objectivies of the COSIN. From this page it is possible to access the complete list of *Work Packages, Deliverables* and *Project Documents.*



- **People:** A list of the people participating and contributing in the COSIN project. Whenever possible a link redirects directly to personal homepages.

- **Publications:** Publications are grouped by year of publication and ordered alphabetically according to the first author surname. Articles are easily accessible and are saved in pdf format.

- **Software:** The tools that have been developed within the COSIN project to



handle, explore, and analyze complex networks.

- **Visualization:** A collection of visualization tools for complex networks.

- **Network data:** Network data sets are grouped into thematic areas and available to download.

Data sets

The network approach is nowadays applied for the analysis of data as diverse as the internet and the physical interaction of proteins of a living system. For this reason, we have grouped network data sets in three general groups:

- **Technological networks**:

  Artificial systems with technological impact: web page sets, internet graphs and traceroutes.

- **Social networks**

  Systems of interacting people: actor data sets and u.s. patents. In the first case the network is composed by actors and a link is drawn if two actors happen to have played in the same movie. In the second case we have a directed graph. The vertices are the patents and the edges are citations to a previous patent.

- **Biological networks**

Molecular interaction models of living organisms and interaction between organisms: protein-protein interaction, protein folding, metabolic pathways and food-webs.

Web Interface

Every data set page includes relevant information concerning the network, including citations if the data

Most of the usage of the data sets is to check their statistical properties in order to validate or introduce new models. Actually, also because of COSIN activity it has been established at least in the field of Statistical Physics a series of basic checks on the statistical properties of data.

Those basic measure are

The frequency distribution of the vertices degree

The function Knn(k) giving the frequency of the average degree of the neighbours of a vertex whose degree is k

The function c(k) giving the average clustering coefficient of a vertex whose degree is k

The average betweenness of a vertex whose degree is k

In order to help the user of the data collection we realised a form in which this basic analysis can be done automatically not only for the data set stored, but for any data set the user might want to upload on the site.

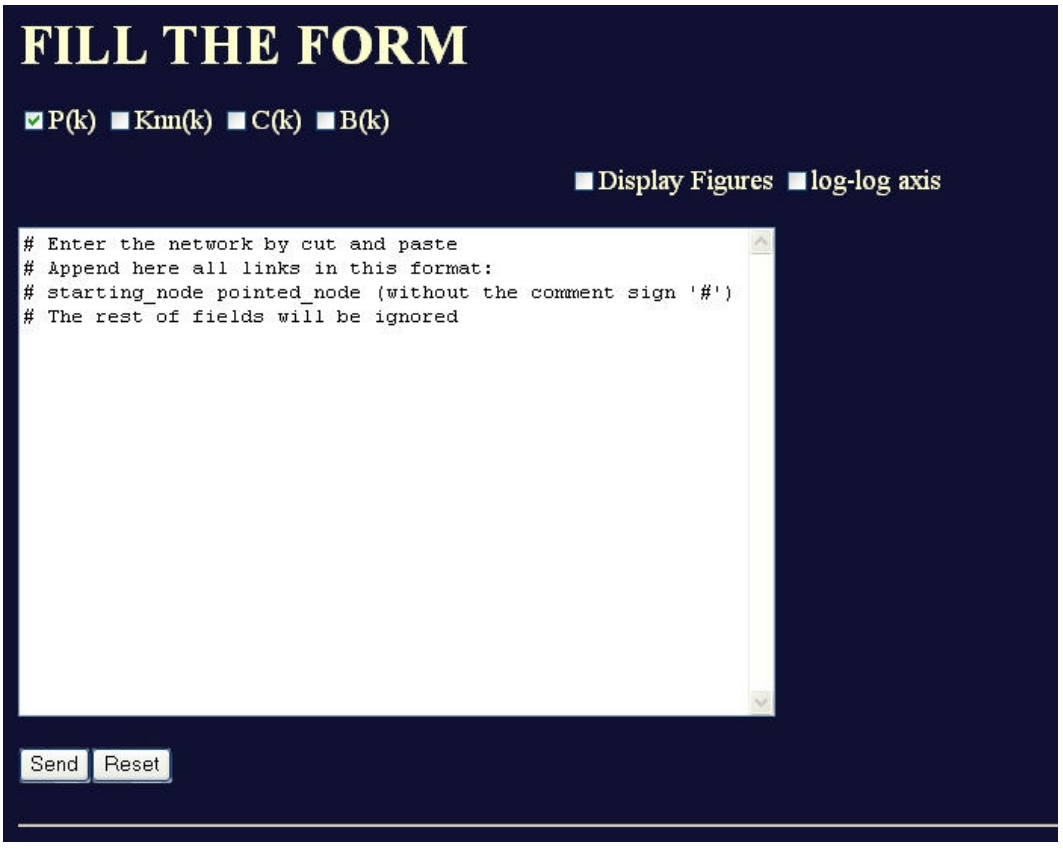


Figure 3: The FORM to upload the data into the interface

The method of upload is by cut and paste and the format required is very simple consisting in two different columns the first one for the starting vertex and the second one for the destination one. In order to be able to use other format that specify further information, the other fields (If present) are ignored.

Once introduced the data in the form. the code compute the betweenness of the various vertices using the algorithm made by Ulrik Brandes, computes the degree and the clustering coefficient and plots those file by making use of the open source programme for fitting function xmgrace.

Upon request of the user the images of the plots can be visualized and eventually saved thereby simplifying the work of analysis for the scientists interested in the field of scale-free networks.

As a simple example of the kind of analysis that can be done we report here a case of study where the user wants to produce a Barabasi-Albert graph of small size (1250 edges). Upon request from the form the code produce automatically the graph and display it on the screen (The figure can be enlarged, and rotated)

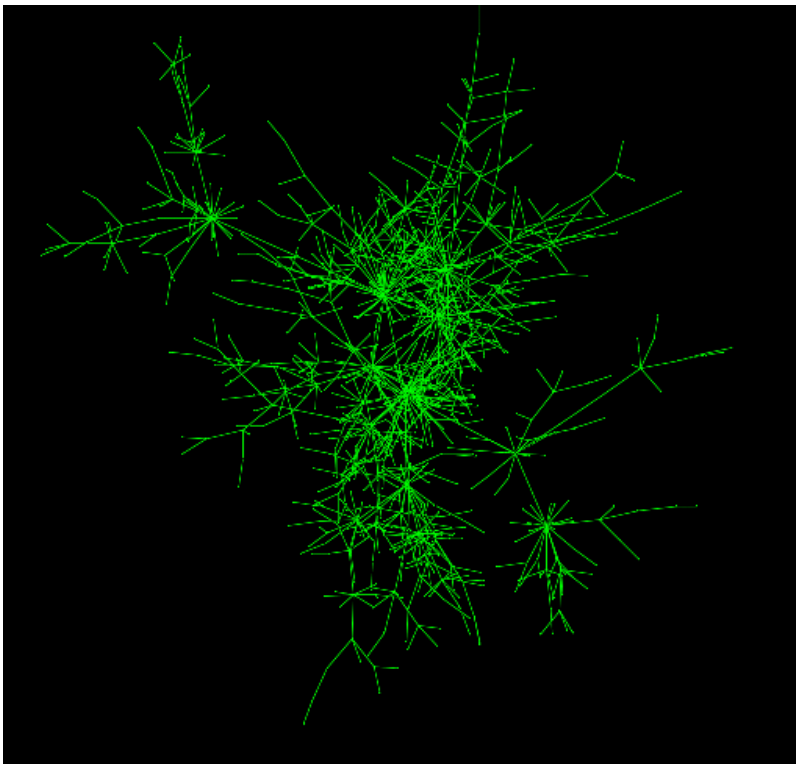


Figure 4 The first output of the code. It represents a Barabasi-Albert "tree" (Actually there is one small cycle of length 3 that is the initial graph. Then the choice of parameter is m=1, and N0=3)

The first picture that is visualized is the graph itself (see Fig 4). Then according to the user requests we have the further pictures representing the plot of the various statistical quantities

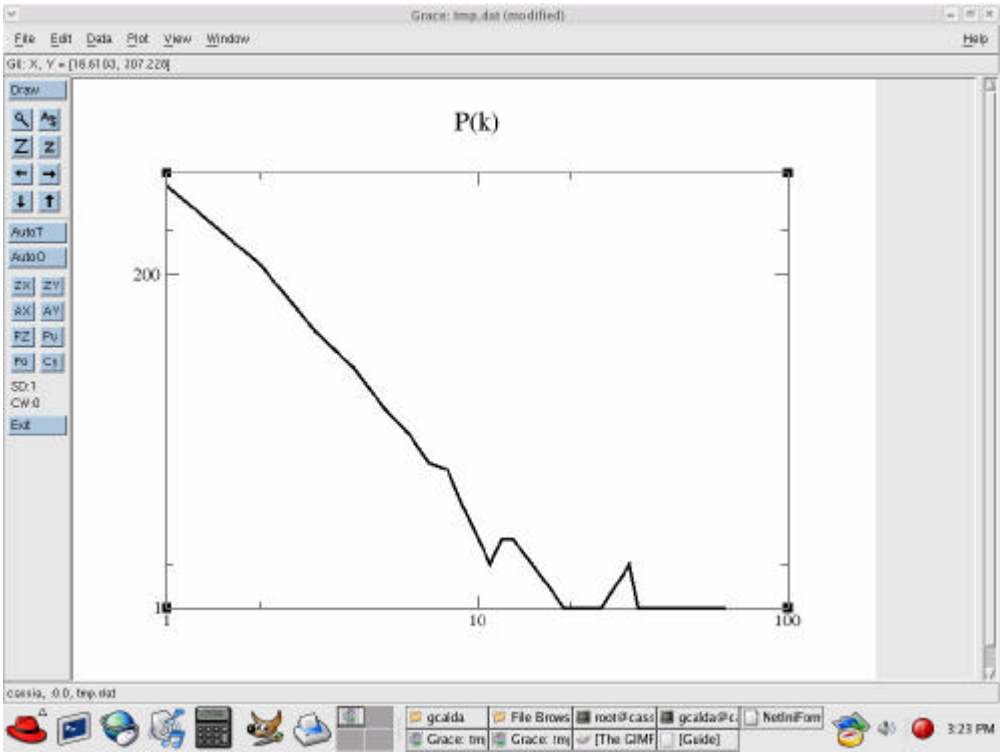


Figure 5 A screen shot showing the statistical analysis of the data created. The plot is made through the open source code xmgrace running under Linux.