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TGTP - Thousands of Geometric problems for geometric Theorem Provers

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TGTP Goal

The principal motivation in building **TGTP**[1] is to support the testing and evaluation of geometric automated theorem proving (GATP) systems, to help ensure that performance results accurately reflect the capabilities of the GATP system being considered.

TGTP is a library of problems, in geometry, for GATP systems.

TGTP aims to supply the automated reasoning in geometry community with a comprehensive library of GATP test problems, in order to provide an overview and a simple, unambiguous reference mechanism.

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[1]http://hilbert.mat.uc.pt/TGTP

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State of the Art

There are several systems integrating dynamic geometry softwares (DGS), GATPs, and a set of examples. For example:

- *Java Geometry Expert (JGEX)* (. . .). It contains a large set of examples of proofs.

- *GEOTHER* (. . .). It contains a collection of theorems in both elementary and differential geometry.

- *GeoThms* (. . .) a library of geometric problems (. . .).

Many of the DGSs (*GeoGebra*, *Cabri*, *Cinderella*, . . .), DGSs/GATPs (*GCLC*, *GeoView*, *GeoProof*, *Geometry Explorer*, *MMP/Geometer*, *GEX*, *Discover*, . . .), and also GATPs (*Theorema*, . . .) come with a (some times, large) set of examples.

However none of them try to provide a common platform for meaningful system evaluations and comparisons.

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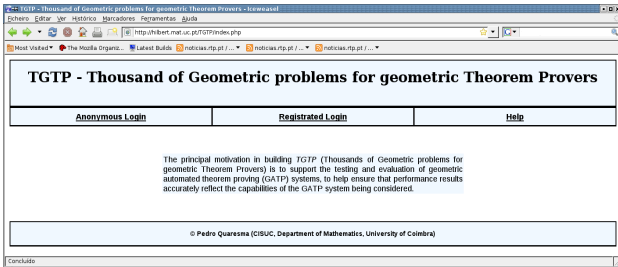
State of the Art & TGTP

A common library of problems is necessary for meaningful
system evaluations and comparisons, its size is important if the
production of statistically significant results is intended.

The goal for building **TGTP** is, in a similar spirit of *TPTP* and
other libraries of problems, to provide the GATP community
with a centralised problem collection with an easy access to all
researchers.

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Relevant Issues: Web-Based

TGTP tries to address all relevant issues. In particular:

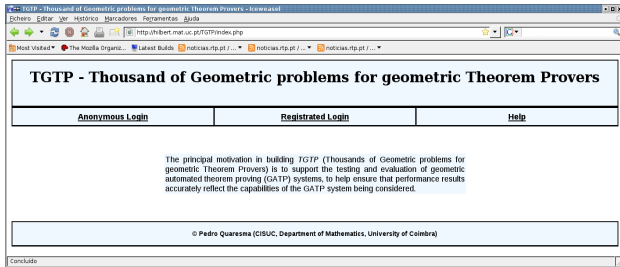- is Web-based and is thus easily available to the research community.

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Relevant Issues: Web-Based

TGTP tries to address all relevant issues. In particular:

- is Web-based and is thus easily available to the research
  community.

- Anonymous Login — see/get all the info;

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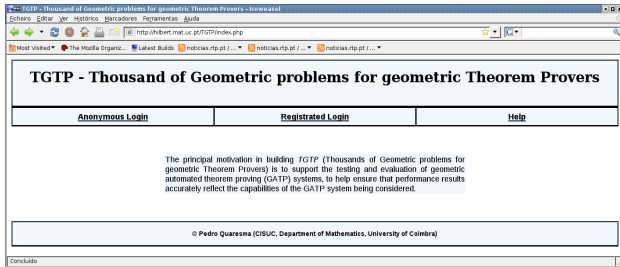
Relevant Issues: Web-Based

TGTP tries to address all relevant issues. In particular:

- is Web-based and is thus easily available to the research
  community.

- Anonymous Login — see/get all the info;
- Registered Login — see/get/add/modify all the info.

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Easy to Use

- is easy to use. Problems (conjectures and proofs attempts) are presented in a small set of Web-pages with all the relevant information.

TGTP - Thousand of Geometric problems for geometric Theorem Provers

Documents/Help	Problems List	Workbench	Downloads	Logout

Show all ▾   N. rows 10 ▾   **Page 1 of 14** **136 Problems**   Home Pg Up Pg Dn End   Search by Name ▾

reset to default values

Code	Name	Short Description	N. Proofs/N. Attempts	
GEO0251	Six Points Circle		1/3	See details
GEO0281	Adams Circle		0/3	See details
GEO0227	Brahmagupta s Theorem		1/3	See details
GEO0268	Butterfly theorem		1/3	See details
GEO0272	Circumscribed Circle Exists Theorem		3/3	See details
GEO0228	Dual Altitude Theorem		3/3	See details

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Documents/Help	Problems List	Workbench	Downloads	Logout

Problem: GEO0315

File	GEO0315
Problem	Euler Line Theorem
Short Description	
Bibliographic Reference	
Contributer	Goran Predovic
Status	Proved
Rating (n.proofs/n.attempts)	3/4
Code XML	XML file Aux/GEO0315_20100713111712.xml (to download)
Proof Attempt 1	GCLC Area Method: 9.00, Proved
Proof Attempt 2	GCLC Wu Method: 9.00, Proved
Proof Attempt 3	GCLC Gröbner Basis Method: 9.00, Proved
Proof Attempt 4	COQareaMethod: 1.0, Time-out: Failed to prove the conjecture

Download Report File (text format)	report GEO0315

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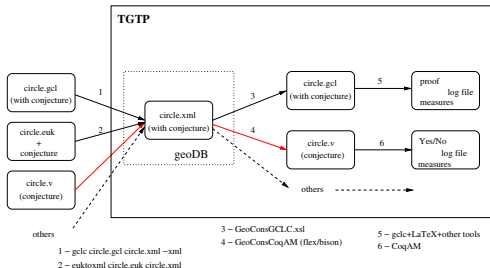Quaresma

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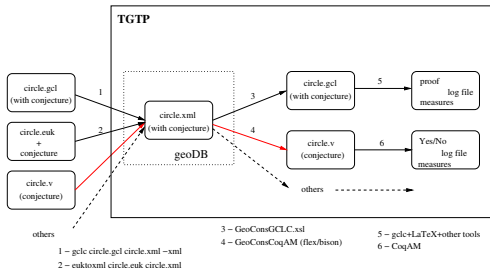Issues
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Relevant Issues: Automatic Conversion

- Automatic conversion to other known formats is being provided, thus eliminating the necessity for any other transcription.

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Relevant Issues: Automatic Conversion

- Automatic conversion to other known formats is being provided, thus eliminating the necessity for any other transcription.

- XML Suite (Pedro Quaresma et.al. in *Communicating Mathematics in The Digital Era*, 2008)

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Relevant Issues: Automatic Conversion

- Automatic conversion to other known formats is being provided, thus eliminating the necessity for any other transcription.

- XML Suite (Pedro Quaresma et.al. in *Communicating Mathematics in The Digital Era*, 2008)
- i2g, InterGeo Common File Format + conjectures.

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All Forms of GATP

- tries to cover the different forms of automated proving in geometry, e.g. synthetic proofs and algebraic proofs.

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All Forms of GATP

- tries to cover the different forms of automated proving in geometry, e.g. synthetic proofs and algebraic proofs.

- is independent of any particular GATP system.

  - GCLC Area Method (synthetic/algebraic);

  - Coq Area Method (synthetic/algebraic);

  - GCLC Wu's Method (algebraic);

  - GCLC Gröbner Bases Method (algebraic).

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Statistically Significant Testing

- aims to become large enough for statistically significant testing. In its current version it contains already over 170 problems.

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Statistically Significant Testing

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Statistics/Proof Status

	attempts	succeeded	%of success	min. time	max. time	avg. time
Coq - Area Method	76	68	0.89	0.73	213.71	17.698
GCLCprover - Area Method	123	62	0.5	0	360.235	9.194
GCLCprover - Wu's Method	96	88	0.92	0	6.404	0.422
GCLCprover - Gröbner Basis Method	96	56	0.58	0	112.319	5.393

Proved	1
Disproved	2
Failed to prove the conjecture	3
Time-out: Failed to prove the conjecture	4
Maximal number of proof steps reached: Failed to prove the conjecture	5
The conjecture out of scope of the prover	6

	Coq - Area Method		GCLCprover - Area Method		GCLCprover - Wu's Method		GCLCprover - Gröbner Basis Method	
TheoId	status	CPU time	status	CPU time	status	CPU time	status	CPU time
GEO0001	1	3.32	1	0.004				
GEO0002			1	0.028				
GEO0003			1	0.003				
GEO0004			1	0.002				
GEO0005			1	0.037				
GEO0006			1	0.002				

- aims to become a comprehensive, up-to-date library.

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Well Structured

- it aims to be well structured and documented. This allows effective and efficient use of the library.

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Well Documented

- documents each problem. This contributes to the unambiguous identification of each problem.

- bibliographic reference for each problem and (eventually) each proof.

- documentation for the different methods, and GATPs;

- List of bibliographic references.

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Adding New Problems

- a workbench to test/add new problems.

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Adding New Problems

- a workbench to test/add new problems.

- access to the list of problems in the database;

Adding New Problems

- a workbench to test/add new problems.

  - access to the list of problems in the database;
  - personal *scrapbook*;

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Adding New Problems

- a workbench to test/add new problems.

  - access to the list of problems in the database;
  - personal *scrapbook*;
  - addition of problems (referring|registered users) to the database;

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Distribution

The information, and the supporting programs will be freely
available.

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Distribution

The information, and the supporting programs will be freely available.

- The Database contents, and the ERD.

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Distribution

The information, and the supporting programs will be freely available.

- The Database contents, and the ERD.

- The format conversion programs.

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Distribution

The information, and the supporting programs will be freely available.

- The Database contents, and the ERD.

- The format conversion programs.

- The list of problems for each GATP.

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Distribution

The information, and the supporting programs will be freely
available.

- The Database contents, and the ERD.

- The format conversion programs.

- The list of problems for each GATP.

- Other supporting programs.

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Open Problems

- Common Format.

  The extension of the i2g format for the GATPs.

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Open Problems

- Common Format.

  The extension of the i2g format for the GATPs.
  ⇒ a script to apply all the GATPs to all the problems.

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Open Problems

- Common Format.

  The extension of the i2g format for the GATPs.
  $\Rightarrow$ a script to apply all the GATPs to all the problems.

- Querying.

  The development of geometric/mathematic searching
  mechanism (semantic geo-contents, semantic
  math-contents).

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In the *GeoThms* system the author and Predrag Janičić already addressed some of the issues that are now being laid down for *TGTP*, namely the XML common format, and the list of problems.

Where the *GeoThms* goal is to have a publicly accessible and widely used Internet based framework for constructive geometry with a strong integration of DGSs, GATPs and a library of problems to those tools.

The *TGTP* goal is to provide the GATP community with a centralised problem collection, independent of any particular GATP system.

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The development of *TGTP* problem library is an ongoing project, aiming to provide all of the desired properties described above.

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Thank You