Combinatorial methods, from enumerative topology to random discrete structures and compact data representations

Results in Brief

New advances in bijective combinatorics

A European team of experts in combinatorics successfully developed a bijective theory of map enumeration on surfaces.

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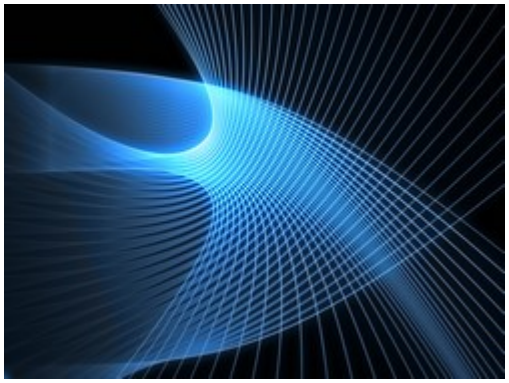

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The EXPLOREMAPS (Combinatorial methods, from enumerative topology to random discrete structures and compact data representations) project built on recent combinatorics advancements to address a number of deeply connected problems that have independently arisen in enumerative topology, statistical physics and data compression. Focus was placed on the notion of a combinatorial map, a natural discrete mathematical abstraction of objects with 2D structures.

Using algorithmic and enumerative combinatorics, scientists showed that classical graph exploration algorithms, when correctly applied to maps, lead to remarkable decompositions of the underlying surfaces. The team confirmed that classical

exploration algorithms lead to obtaining context-free decompositions of discrete surfaces through a unified framework that encompasses plane, higher-genus and non-orientable surfaces.

Finally, a parallel theory was developed for combinatorial models of Riemann surfaces, providing new insight into the famous Hurwitz simple and double numbers.

Project members also designed new graph drawing and random sampling algorithms, and proposed new encodings and data structures for the succinct representation of 2D geometric objects. Project achievements also include use of probability theory on random discrete surfaces, especially for the study of the continuum limit of large random maps.

Keywords

Bijective combinatorics | EXPLOREMAPS | enumerative topology | combinatorial map | enumerative combinatorics

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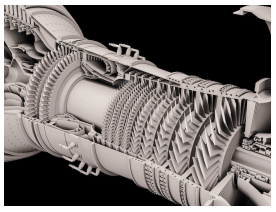

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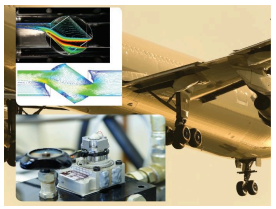

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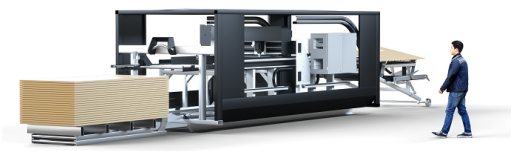

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Project Information

EXPLOREMAPS

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Project closed

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