DefElement

an encyclopedia of finite element definitions

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What is DefElement?

DefElement is an online encyclopedia of finite element definitions. You can view it at

defelement.com

DefElement includes definitions of a huge range of finite elements including commonly used elements such as Lagrange, Raviart–Thomas [6], and Nédélec [4, 5]; and more exotic elements such as Argyris [1], Regge [7, 2], and TNT [3].

What information is on DefElement?

- Name(s) of the element
- Definition and properties of the element
- Implementations of the element
- Example DOF diagrams and basis functions, with plots created using Symfem [8]
- References

All the information and diagrams on DefElement are available for reuse under a Creative Commons CC BY 4.0 license: you can use them for free as long as you link to or cite DefElement. All the diagrams are available to download in PNG, SVG, and TikZ formats.

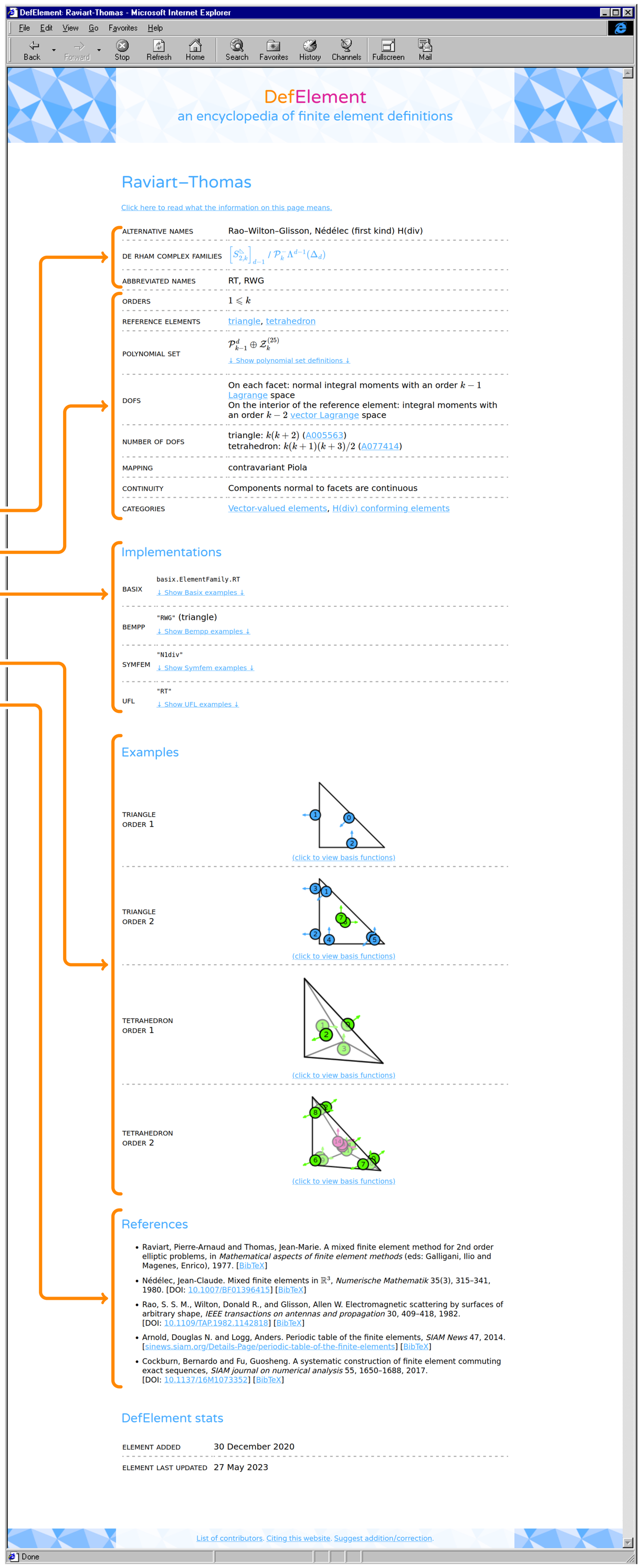
Can I contribute to DefElement?

Yes! DefElement's source code is available on GitHub (MIT license). You can contribute by opening GitHub issues for:

- New elements that could be added to DefElement.
- Any improvements that you want to suggest.
- Any mistakes that you find.

Or, you could fork the repository and open a pull request to:

- Add implementation information for a finite element library that you use or maintain.
- Resolve any of the currently open issues: keep an eye out for anything tagged *good first issue*.
- Anything else you want to suggest changing.



References

[1] John H. Argyris, Isaac Fried, and Dieter W. Scharpf. The TUBA Family of Plate Elements for the Matrix Displacement Method. *The Aeronautical Journal*, 72(692):701–709, 1968.

[2] Snorre H. Christiansen. On the linearization of Regge calculus. *Numerische Mathematik*, 119(4):613–640, 2011.

[3] Bernardo Cockburn and Weifeng Qiu. Commuting diagrams for the TNT elements on cubes. *Mathematics of Computation*, 83:603–633, 2014.

[4] Jean-Claude Nédélec. Mixed finite elements in $\mathbb{R}^3$. *Numerische Mathematik*, 35(3):315–341, 1980.

[5] Jean-Claude Nédélec. A new family of mixed finite elements in $\mathbb{R}^3$. *Numerische Mathematik*, 50(1):57–81, 1986.

[6] Pierre-Arnaud Raviart and Jean-Marie Thomas. A mixed finite element method for 2nd order elliptic problems. In Ilio Galligani and Enrico Magenes, editors, *Mathematical aspects of finite element methods*, volume 606, pages 292–315. 1977.

[7] Tullio Regge. General relativity without coordinates. *Il Nuovo Cimento*, 19(3):558–571, 1961.

[8] Matthew W. Scroggs. Symfem: a symbolic finite element definition library. *Journal of Open Source Software*, 6(64):3556, 2021.