

# On the decomposition of ternary matroids

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Matroids were introduced by Whitney in 1935 to try to capture abstractly the essence of dependence. Matroids generalize linear dependence over vector spaces, and they also abstract the properties of graphs, in the former case they are called *Vector Matroids*, in the latter they are called *Graphic Matroids* [3]. The operation of Matroid Union was introduced by Nash-Williams in 1966. A matroid is irreducible (indecomposable) if it does not decompose as the union of non-trivial matroids [3]. In 1971 Welsh posed the problem of characterizing indecomposable matroids, this problem has turned out to be extremely difficult. As a partial solution towards its progress, Cunningham characterized binary indecomposable matroids in 1977 [1]. One interesting feature of matroids, is that some elements in the matroid can be geometrically moved to a different location without changing the structure of the matroid, whereas others cannot. The former elements are called *non-fixed* and the latter *fixed* [2]. Using the notion of fixed and non-fixed elements, we have found a fresh way of stating Cunningham's result, an interesting way of linking binary and ternary matroids, and discovering a necessary condition for characterizing decomposable ternary matroids: **'If a ternary matroid is decomposable then it contains at least two non-fixed elements'**. Finally I will present how to compose a ternary matroid, and what property a ternary decomposition has. This is a joint work with Professor Geoff Whittle from Victoria University of Wellington.

## References

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- [2] Geelen, James. Oxley, James. Vertigan, Dirk and Whittle, Geoff. Totally free Expansions of Matroids. *Journal of Combinatorial Theory, Series B* 84, 130-179 (2002).
- [3] Oxley, J.(1992). *Matroid Theory*. Oxford University Press, New York.