Re: Why is there no *really* useful Algebra beyond complex numbers?

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- *From*: Jim Spriggs <jim.sprigs@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>

- *Date*: Tue, 31 May 2005 15:54:01 +0000 (UTC)

Anton Suchaneck wrote:
>
> > (ax + by)z = a(xz) + b(yz) and x(ay + bz) = a(xy) + b(xz).
> Does that define multiplication once addition is established?
> > If
> > x/y
> >
> > is defined for all y not equal to (0, 0, ..., 0) then the algebra is
> > said to be a _division_ algebra.
> Would it give us more possibilities if we only required that say triple
> expressions are 1? i.e. xy/z
> > Now here's the rub: only for certain n can can an n−dimensional real
> > algebra have the above properties:
> >
> > (1) Only for n = 1 and 2 are there n−dimensional real commutative
> > division algebras.
> >
> > (2) Only for n = 1, 2 and 4 are there n−dimensional real associative
> > division algebras. For n = 4 the algebra is called the quaternions.
> They are useful for rotations? What else?
> > (3) Only for n = 1, 2, 4 and 8 are there composition algebras with
> > units. For n = 8 the algebra is called the octonions.

> They are non−associative?

Yes.

> In maths it's all about inverting operations and isolating an expression on
> one side of an equation?

To say that maths is _all_ about that would seem to be rather limiting.

> So it must be difficult to deal with
> non−associative structures??

I'm sure they have some use.

> > Note that already in the case n = 2 (the complex numbers) there is no

> > order as there is on the reals. So one looses something even with the
> > complex numbers.

> So what is so special about complex numbers to allow them things like
> contour integrals?
>
> Is there any non−algebraic mathematical system that can be calculated with?
> For example for applications in physics, game theory, system theory or
> whatever?

You can do arithmetic with games. See Conway "On Numbers and Games".
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- ***References***:
  - ***Why is there no *really* useful Algebra beyond complex numbers?***
    - *From:* Anton Suchaneck
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    - *From:* Jim Spriggs
  - ***Re: Why is there no *really* useful Algebra beyond complex numbers?***
    - *From:* Anton Suchaneck

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