VORTEX-BASED MATHEMATICS IS MODULAR ARITHMETIC

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Abstract. We show that vortex-based mathematics on integers in any base can be done with modular arithmetic.

1. Introduction

There has been recent interest by the public in a curious pattern that emerges when doubling integers: $1, 2, 4, 8, 7, 5$. Twice 8 is 16 and $1 + 6 = 7$. Twice 16 is 32, and $3 + 2 = 5$. Is this new and useful mathematics or is this part of existing theory? Define a map $f : \mathbb{Z}^+ \longrightarrow \mathbb{Z}^+$ by sending the base 10 representation of the positive integer $n = \sum_{k=0}^{m} a_k 10^k$ to $\sum_{k=0}^{m} a_k$. Let $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ and

$$\rho : \mathbb{Z}^+ \longrightarrow S$$

be the map obtained by repeatedly applying f until a single digit is obtained or, more generally, until an integer less than the base is obtained. For example, $f(59503) = 5+9+5+0+3 = 22$ and $f(22) = 2+2 = 4$ so $\rho(59503) = 4$. The discovery of the map ρ has been attributed to the Beverly Hills thinker Marko Rodin, who has made some bold claims about ρ regarding free energy and ending disease among others. On first introduction to the topic dubbed *Vortex-based Mathematics*, it seems to have more in common with Numerology or Metaphysics than Number Theory. To quote Rodin, "Nikola Tesla said, If you knew the magnificence of the 3, 6 and 9, you would have the key to the universe. To be truly accurate, the key is really the $3 \cdot 9 \cdot 6$ Pilot Wave, and it's the secret to overunity energy amplification." The significance of this statement is not immediately clear. However, one of the most elementary observations we can make about ρ from a mathematical point of view is that there is much in common with modular arithmetic. The purpose of this note is to show that Vortex-based mathematics is really just modular arithmetic in disguise. The main result proved in Theorem 2.1 is elementary, however there is much Online discussion on vortex-based mathematics, several videos devoted to the topic – some with millions of views and comments claiming it to be a life changing revelation, a recently published book [1], and even a course in the topic has been offered. Evidently many people with an interest in elementary mathematics have been drawn into this topic and should be redirected to learning about modular arithmetic. We begin by discussing the similarities with modular arithmetic and then proceed to demystify the topic in the statement of Theorem 2.1, where we state that vortex-based math in any base is the same as performing modular arithmetic.

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The following remark gives our first hint to the nature of the so called vortex calculations.

Remark 1.1. The map ρ satisfies

$$\rho(mn) = \rho(\rho(m)\rho(n)).$$

Remainders modulo d have a similar property. If $n_1 = dq_1 + r_1$ and $n_2 = dq_2 + r_2$, then $n_1 n_2 = dq_3 + r_1 r_2$, where $q_3 = dq_1 q_2 + q_2 r_1 + q_1 r_2$. For this reason we refer to $\rho_b(n)$ as the *Rodin remainder* in base b. Usually, mathematical programming can shed some light on such coincidences. The following *Mathematica* [5] functions calculate the Rodin remainder in base 10 and by changing the value of b, the calculations can be done in any base.

```
b = 10;
f[m_] := Module[{t, u}, t = IntegerDigits[m, b]; u = Length[t];
   Sum[t[[j]], {j, 1, u}]];
rodin[m_] :=
  Module[{}, NestWhile[f, m, Length[IntegerDigits[#, b]] > 1 &]];

Table[rodin[n], {n, 1, 25}]
Table[Mod[n, b - 1], {n, 1, 25}]
```

Upon running the code, the truth becomes clear; modular arithmetic governs Rodin's theory.

2. The main result

Perhaps the most well known observation about the Rodin remainder is that for all positive integers n, $\rho_{10}(2^n)$ is not equal to 3, 6 or 9 and recurs in the pattern $1, 2, 4, 8, 7, 5$. This is a consequence of the following elementary observation which shows that the complicated calculations performed with vortex-based mathematics can be performed more easily with modular arithmetic since the Rodin remainder in base 10 of n is the actual remainder of n modulo 9.

Theorem 2.1. *Let $b, n \in \mathbb{Z}^+$ and $b \geq 2$. Then $\rho_b(n) \equiv n \pmod{b-1}$, and if $b-1 \mid n$, then $\rho_b(n) = b-1$.*

Proof. We prove the claim by induction. $\rho_b(1) = 1 \equiv 1 \pmod{b-1}$. Assume that $\rho_b(m) \equiv m \pmod{b-1}$ and let $m = (b-1)q + r$, where $0 \leq r < b-1$. Then $\rho_b(m+1) = \rho_b(\rho_b(m) + \rho_b(1)) = \rho_b(r+1) \equiv r+1 \pmod{b-1}$ since $r+1 \leq b-1$. By the principle of induction it follows that $\rho_b(n) \equiv n \pmod{b-1}$. It remains to show that $\rho_b(k(b-1)) = b-1$. We know that $\rho_b(k(b-1)) \equiv 0 \pmod{b-1}$. Since $\rho_b(k(b-1))$ cannot be equal to 0, we must have $\rho_b(k(b-1)) = b-1$. □

Since $2^{6q+r} = 2^{6q} \cdot 2^r \equiv 2^r \pmod 9$, we see that if $n \equiv 1 \pmod 6$, then $\rho_{10}(n) = 1$, and if $n \equiv 2 \pmod 6$, then $\rho_{10}(n) = 2$, and so on. Hence it is clear how we obtain the recurring sequence $1, 2, 4, 8, 7, 5$ from the powers of 2.

Now that we know that the Rodin remainder is essentially the remainder, we consider whether there is any value in the alternate computation of the remainder. In order to apply Euclidean division to express a positive integer n according to the quotient remainder theorem $n = dq + r$, where $0 \leq r < d$, one division by d is necessary. If the base $d+1$ representation of n is known, then Rodin's observation means that the remainder of n modulo d can be found using only additions. Rodin's calculation of the remainder of an m digit number requires $O(m)$ additions of integers that are less than or equal to d. So, to be fair, it can facilitate mental arithmetic of remainders modulo 9 by avoiding division.

Having not delved deeply into the entire philosophy of vortex-based mathematics and the broader teachings of Rodin [3], it is possible that the author has overlooked some of the mathematics among the ideology of vortex-based mathematics. The contents of the 62 page book [1] seem to suggest that there is somewhat more to the theory, such as the extension of the map ρ to the rationals. In fact, the author was disappointed to realize that Theorem 2.1 holds since Rodin's diagrams [3] look beautiful and inviting. The main message we wish to convey is that possibly some of the calculations involved in Rodin's ideas about Physics [2] might be performed working modulo 9 and that individuals interested in those topics might find modular arithmetic and elementary Number Theory more rewarding; see the elementary book by LeVeque [4] for example.

References

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