

I am currently thinking about exercise 9.3 on page 161 of RTR.
The part of the Laurent series with positive powers of z is written, at the top of page 160, as:

$$F^- = \alpha_1 z^1 + \alpha_2 z^2 + \alpha_3 z^3 + \dots$$

and the part with negative powers of z as

$$F^+ = \dots + \alpha_{-3} z^{-3} + \alpha_{-2} z^{-2} + \alpha_{-1} z^{-1}$$

On page 159 just above figure 9.5 Penrose draws the reader's attention to note 9.3 on page 177 to explain why there is the confusing notation of F^- for positive powers of z and F^+ for negative powers of z .

OK so far?

Then, on page 161, at the beginning of section 9.3, Penrose writes :

'We think of our splitting of $F(z)$ as expressing it as a sum of two parts, one of which extends holomorphically into the southern hemisphere - called the *positive-frequency* part of $F(z)$ - as defined by $F^+(z)$, together with whatever portion of the constant term we choose to include, and the other, extending holomorphically into the northern hemisphere - called the *negative-frequency* part of $F(z)$ - as defined by $F^-(z)$ and the remaining portion of the constant term....'

Penrose has done something here which is potentially confusing, even though he seems to be trying to make things less confusing. He originally says, in section 9.2 pages 159 - 160, **positive powers of z , corresponding to F^-** , and then in section 9.3 he switches to talking about the **positive-frequency part of $F(z)$ corresponding to F^+** etc. This new wording associates **positive** frequencies with F^+ and vice versa.

Now, from looking at note 9.3 and its reference to section 24.3 of RTR, it is clear that **negative powers** correspond to **positive frequencies and vice-versa**.

By changing his wording here, in an attempt to cause less confusion to the reader, Penrose seems to have confused himself, and, as a result the quotation above from page 161 contains an error.

It is clear from figure 9.5 that the **negative frequency** part of $F(z)$ extends into the **southern hemisphere** and vice versa. There are several ways to correct this quotation. One is the following:

‘We think of our splitting of $F(z)$ as expressing it as a sum of two parts, one of which extends holomorphically into the southern hemisphere - called the ***negative-frequency*** part of $F(z)$ - as defined by $\mathbf{F}^-(\mathbf{z})$, together with whatever portion of the constant term we choose to include, and the other, extending holomorphically into the northern hemisphere - called the ***positive-frequency*** part of $F(z)$ - as defined by $\mathbf{F}^+(\mathbf{z})$ and the remaining portion of the constant term....’.

The sections in bold are the ones I have changed.

Please let me know if you agree with my correction.