

**Aart Goossens**[Follow](#)

Python developer at Elements Interactive. Writing for Critical Powers. Dreaming of sports science, data and entrepreneurship.

Oct 5, 2016 · 3 min read

Formulas from 'Training and Racing with a Power Meter'

Introduction

This article will give you the formulas (or 'algorithms') for several metrics that are introduced or explained in the book 'Training and Racing with a Power Meter' by Hunter and Allen:

- Normalized Power
- Intensity Factor
- Training Stress Score
- Chronic Training Load
- Acute Training Load
- Training Stress Balance
- Variability Index

I wrote this article because I searched for something like this but could not find it. It would have been useful for me and I hope it will be for you.

. . .

Normalized Power

Normalized Power (NP) is a metric to quantify training intensity with power data and is introduced by Andrew Coggan. The concept of NP is discussed in chapter 7 of the book. It is especially useful in conjunction with the other algorithms below.

Step 1: Calculate the rolling average with a window of 30 seconds: Start at 30 seconds, calculate the average power of the previous 30 seconds and then for every second after that.

Step 2: Calculate the 4th power of the values from the previous step.

Step 3: Calculate the average of the values from the previous step.

Step 4: Take the fourth root of the average from the previous step. This is your normalized power.

Or in pseudo code:

rolling_average = 30 second rolling average

rolling_avg_powered = rolling_average⁴

avg_powered_values = average of rolling_avg_powered

NP = avg_powered_values^{0.25}

The unit of NP is *Watt*.

. . .

Intensity Factor

Intensity Factor (IF) is the ratio of the Normalized Power (NP, see above) with your Functional Threshold Power (FTP). The concept of IF is introduced by Andrew Coggan and is discussed in chapter 7 of the book.

IF = NP / FTP

Where:

- IF = Intensity Factor
- NP = Normalized Power
- FTP = Functional Threshold Power

IF has no unit, it is *dimensionless*.

. . .

Training Stress Score

Training Stress Score is a metric to quantify training load. It is dimensionless and adapts to changing fitness levels (i.e. your FTP). The concept of TSS is introduced by Andrew Coggan and is discussed in chapter 7 of the book.

$$TSS = ((t * NP * IF) / (FTP * 3600)) * 100$$

Or, if we would be more efficient than the book:

$$TSS = (t * NP * IF) / (FTP * 36)$$

Where:

- TSS = Training Stress Score
- t = duration of workout in seconds
- NP = Normalized Power
- IF = Intensity Factor
- FTP = Functional Threshold Power

TSS has no unit, it is dimensionless.

. . .

Chronic Training Load

Chronic Training Load (CTL) is defined as the average TSS of the last 42 days. The concept of CTL is introduced by Andrew Coggan and is

discussed in chapter 8 of the book. It is really only useful for calculating TSB, see below.

$$CTL = \text{Average TSS of last 42 days}$$

CTL has no unit, it is dimensionless.

. . .

Acute Training Load

Acute Training Load (ATL) is defined as the average TSS of the last 7 days. The concept of ATL is introduced by Andrew Coggan and is discussed in chapter 8 of the book. It is really only useful for calculating TSB, see below.

$$ATL = \text{Average TSS of last 7 days}$$

ATL has no unit, it is dimensionless.

. . .

Training Stress Balance

Training Stress Balance (TSB) is defined as the difference between CTL and ATL. The concept of TSB is introduced by Andrew Coggan and is discussed in chapter 8 of the book.

$$TSB = CTL - ATL$$

TSB has no unit, it is dimensionless.

. . .

Variability Index

The Variability Index (VI) can be used as a metric for how smoothly paced your workout or race was and is defined as the ratio between NP and average power of a workout. The concept of VI is **not** introduced by Andrew Coggan but Charles Howe and is discussed in chapter 8 of the book.

$$VI = NP / P_{avg}$$

Where:

- VI = Variability Index
- NP = Normalized Power
- P_avg = Average power

VI has no unit, it is dimensionless.

