Air Mass From Ideal Gas Law

$$mass(g) = \frac{\Pr essure(kPa) * Volume(L)}{R * Temperature(k)}$$

$$Volumetric\_Flow\_Rate(L/s) = \frac{Engine\_Speed(RPM)}{60 \,{}^{\sec}\!/_{\min}} * \frac{Engine\_Displacement(L)}{2\,{}^{revolutions}\!/_{\text{int}\,ake\_cycle}}$$

$$Air\_Mass\_Flow\_Rate(g/s) = \frac{Manifold\_\Pr essure(kPa) * Engine\_Displacement(L) * Engine\_Speed(RPM)}{120 * 0.2869 * Temperature(k)} * Volumetric\_Efficiency$$

$$Air\_Mass\_Flow\_Rate(g/rev) = \frac{Manifold\_\Pr essure(kPa) * Engine\_Displacement(L)}{2 * 0.2869 * Temperature(k)} * Volumetric\_Efficiency$$

Injector Pulse Width From Mass Balance

$$Fuel\_Mass\_Flow\_Rate(g/s) = \frac{Air\_Mass\_Flow\_Rate(g/s)}{Stochiometric\_AFR(g/g)} * Desired\_AFR(lambda)$$

$$Injector\_Flow\_Rate(g/s) = \frac{\#Injectors * Injector\_Size(cc/\min)}{60\,{}^{\sec}\!/_{\min}} * Fuel\_Specific\_Gravity\left({}^{g}\!/_{cc}\right)$$

$$Injector\_Pulse\_Width(m\sec) = \frac{Fuel\_Mass\_Flow\_Rate(g/s)}{Injector\_Flow\_Rate(g/s)} * \frac{1000}{\dfrac{Engine\_Speed(RPM)}{2\,{}^{revolutions}\!/_{\text{int}\,ake\_cycle} * 60\,{}^{\sec}\!/_{\min}}}$$

$$IPW(m\sec) = \frac{MAP(kPa) * Displacement(L)}{0.2869 * Temperature(k)} * \frac{Desired\_AFR(lambda)}{Stochiometric\_AFR} * \frac{1}{Injector\_Flow\_Rate(cc/\min)} * Volumetric\_Efficiency$$

$$Scaling\_cons\tan t = \frac{Displacement(L)}{0.2869 * Stochiometric\_AFR^{2} * Injector\_Flow\_Rate(cc/\min)}$$

$$IPW(m\sec) = scaling\_cons\tan t * \frac{MAP(kPa) * Desired\_AFR}{Temperature(k)} * Volumetric\_Efficiency$$