

Air Intake Mass and Diesel Engine Performance Analysis Using Neural Networks

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Abstract: Now a days neural network is used to many experiment area for get detail point. One of them is diesel engine technologies. There are lots of factors, at four-stroke six-cylinder a diesel engine's performance. From the engine's important characteristics, the air intake mass has considerable place. In this study, connected with as absorption air intake mass's entrance conditions, changing of engine performance are tested as with intercooling for only five measuring. We calculated and show other detail data by neural networks model.

1. Introduction

At the changing load conditions , middle (1600 rpm) and high (2400 rpm) revolution which volumetric efficiency and absorption air intake changing is experienced at the compressor, precompression to be subjected to air heat is increased. For more air get to cylinder, volumetric efficiency remaining from compressor outlet air is need cool condensation and amount increasing intercooling filling air ,absorption air intake increase. Volumetric efficiency and absorption air intake the most important engine parameters of intercooling without intercooling turbo engine is smaller than intercooling engine. At the without compressor engines press and wining speedily air is warp up to compressor. This result is dilate and density being small. At this conditions entering air to compressor, cooling density increase and but more small and fallen term air is enter to burning room, thus intercooling is positive effect for volumetric efficiency and absorption air intake . We understand, this effect at high and middle load condition is more, at small load and revolution condition is small from experiment results.

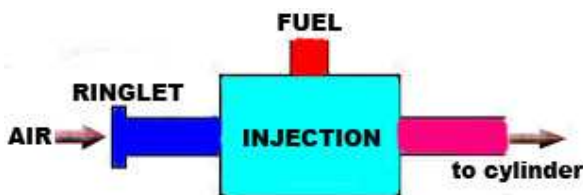


Fig. 1 Diesel engine air intake schema[1]

2. Measurement of air intake mass

Determining engine of volume flow that the most variable contain and require care is measure for the engine of experiment. At the determining emission of characteristic and performance of engine the most important is volume flow. Volume flow must be known for air-flow ratio, air excess coefficient and like volumetric efficiency burning event of detail, emission properties and about suitable working for the enough information. Consequently, amount of air must be measure sensitive for the realist experiment results.

If flowing is standing the most sensitive result is formed with tank of air damping sharp edge pipe and oblique manometer in the survey volume flow. In the experiment capacity of air tank must be littler than engine size's from 50

layers. Size of sharp edge pipe isn't chosen much too from 10 cmSS in the oblique manometer pressure. For sensitive measure we must use a light manometer liquid.

When air pass from narrow pipe cross-section is choked and its pressure goes down. As first state if static air conditions is used, in the 1m far of air tank from Bernoulli equation; [2]

$$\rho_H \frac{V^2}{V} = \Delta p = \rho g h \quad (1)$$

V is air speed in the most narrow cross-section, Δp is difference in the between atmosphere pressure and cross-section pressure. When we consider tip of manometer must open to atmosphere, other tip is narrow cross-section. If air is ideal gas in the atmosphere condition, we use $\rho_H = (p_H \cdot M_H / RT_H)$ for air density.

This definition $R=8134,3$, (J/kmol °K) is universal gas constant , $M_H = 28,96$ (kg/kmol) is mol weight of air, T_H (°K) is air heat one meter of air depot in the distant. If level difference Δ_h (cmSS) in the manometer, given for the PH with from Eq.1;

$$\frac{p_H M_H}{RT_H} \frac{V^2}{V} = 98.0665 \Delta h_h \quad (2)$$

amount of air volume pass the unit time from pipe (m³/s);

$$V^{\&}_H = C_{D,H} \left(\frac{\pi d^2}{4} \right) \left(\frac{196.133 RT_H \Delta h_h}{p_H M_H} \right)^{1/2} \quad (3)$$

At the this definition R and MH are dependent static's and if we put this value at the definition's place;

$$V^{\&} = 186.371 C_{D,H} d^2_H \left(\frac{T_H \Delta h_H}{p_h} \right)^{1/2} \quad (4)$$

Cdh is constant of air tank-ringlet system geometry's and if hole diameter's is more small than main canal's cross section diameter, $C_{D,H} = 0,6$. However if $T_H=298$ °K and $p_h=101325$ (N/m²) and from Eq. 4;

$$V^{\&}_H = 6.064 d^2_H (\Delta h_h)^{1/2} \quad (5)$$

d_H (m) is diameter of ringlet flowing cross-section. We use (1.5) define for mass volume flow[3];

$$V^{\&} = 7.182 d^2_H (\Delta h_H)^{1/2} \quad (6)$$

3. Measuring and Computing Method

We tested engine (Table 1) air intake with intercooling and take some data in 1600-2000 and 2400 rpm about diesel engine performance. Then we calculated other detail data with neural network using the feed-forward back propagation network showed in Fig. 2 [5]. We calculated Motor RPM 1600, 1800, 2000, 2200 and 2400 rpm with intercooling. Crankshaft angels (CSA) are 18, 20, 22. In graphic can be calculated and show air intake mass practical and theoretical in every state (see Fig.2-3, Table 2).

Engine specification for the Ford 6.0 Intercooler , direct injection	
<i>Stroke</i>	4
Compression (Γ^{-1})	16.5
Piston stroke (mm)	114.9
Number of cylinders	6
Cylinder diameter (mm)	104.77
Engine power (kW-2400 rpm)	136
Maximum speed (rpm)	2750-2800
Engine volume (l)	5.947
Injection advance	20
Engine weight	500

Table 1: Engine specification [4]

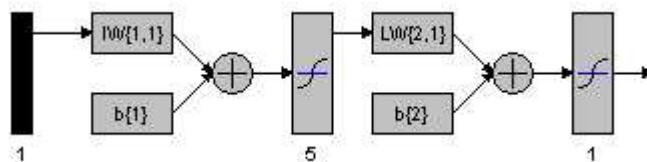


Fig. 2: The neural network model

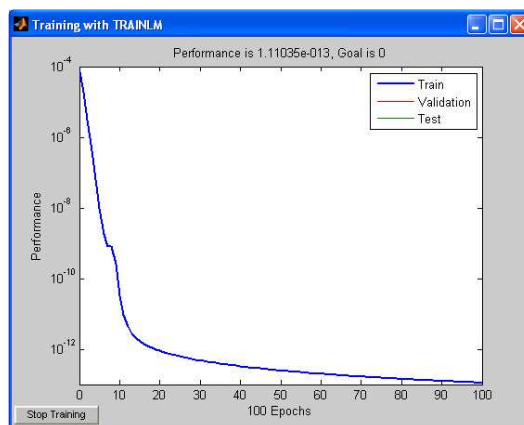
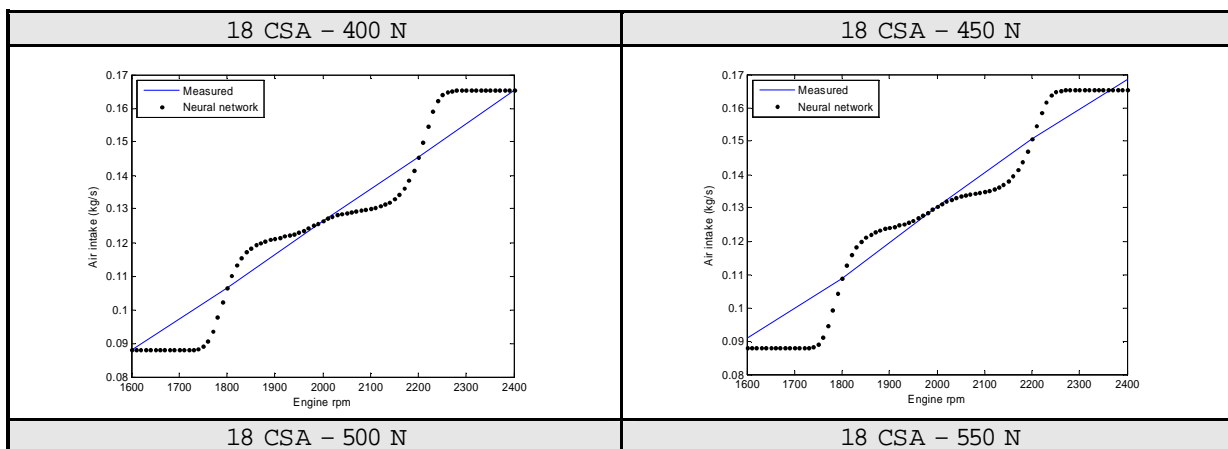
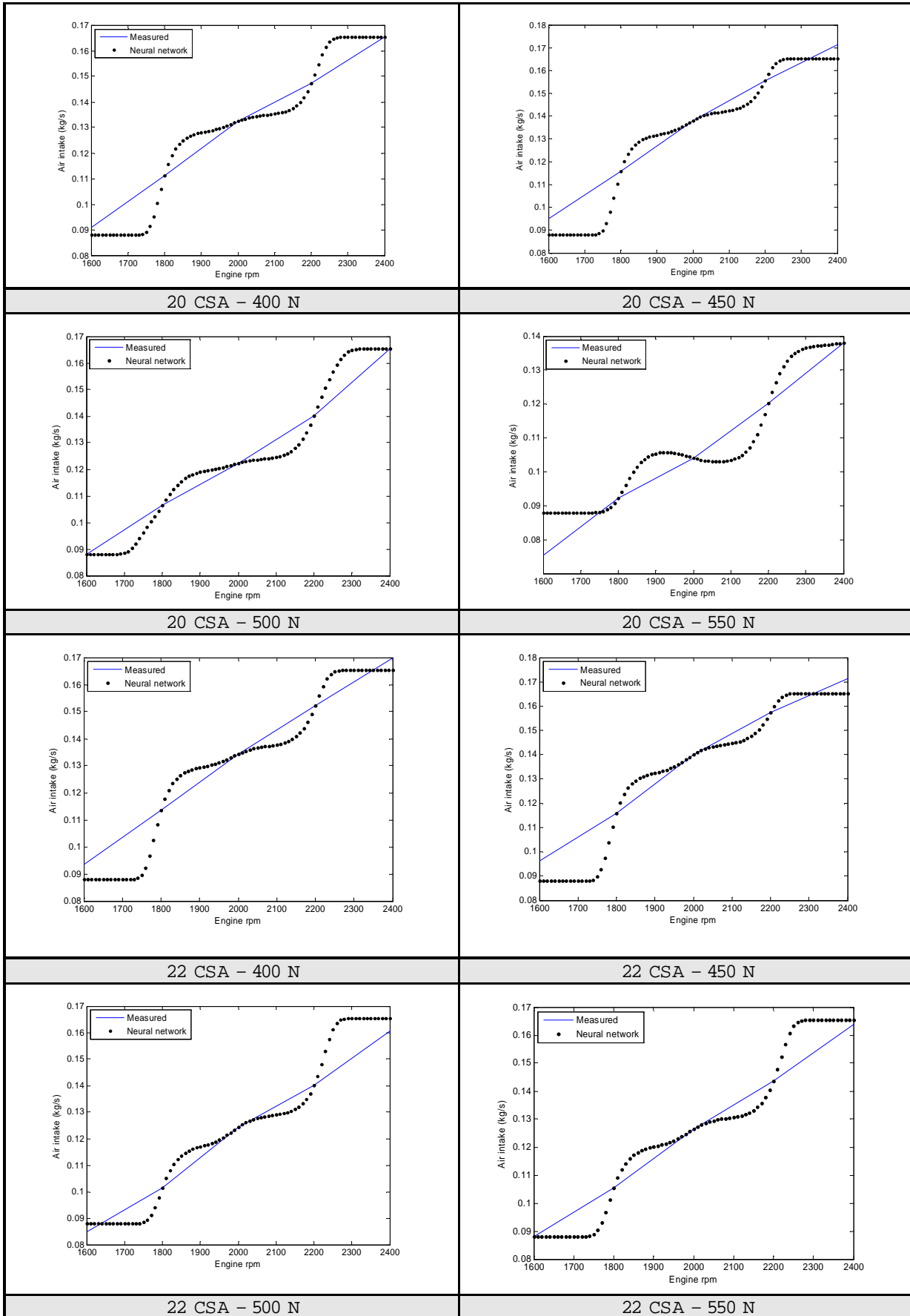


Fig. 3: Sample training graphic





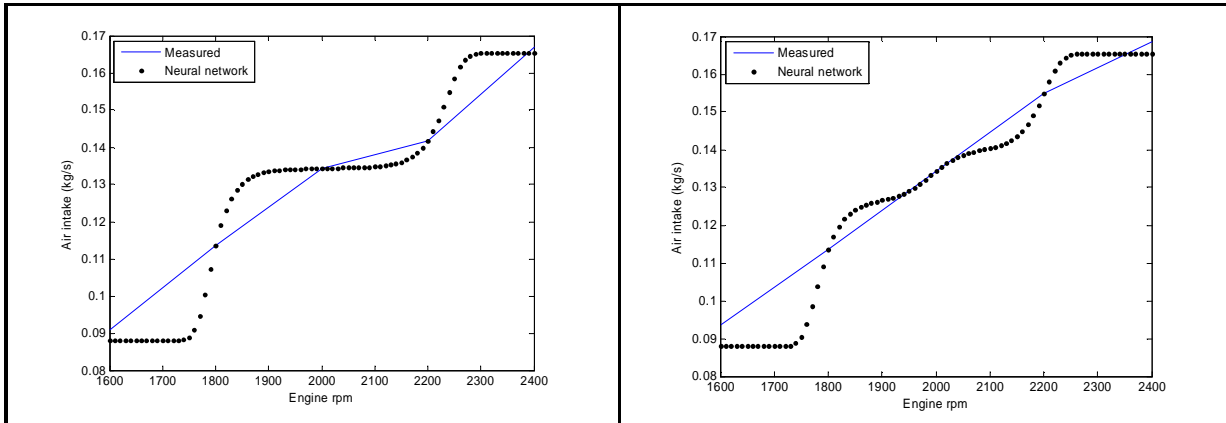


Table 2: Measuring and computing results

4. Conclusions

According to test result and neural network model, intercooling is important, for volumetric efficiency. We can tested for 5 point that experiment (1600–1800–2000–2200–2400 rpm). Then we made model with neural network model and we found detail points like that (1600, 1610, 1620, ...).

At the compressor, pre compression to be subjected to air heat is increased. For more air get to cylinder, volumetric efficiency remaining from compressor outlet air is need cool condensation and amount increasing Intercooling filling air, absorption air intake increase . Volumetric efficiency and absorption air intake the most important engine parameters of intercooling without intercooling turbo engine is smaller than intercooling engine. At the without compressor engines press and wining speedily air is warp up to compressor. This result is dilate and density being small.

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