$F.(N),\ 1\otimes\partial_N) = \underset{p+q\geq 0}{Tor^{\mathcal{O}}_{p+q+1}}(N, M)$. Refer to p142. Hu. Homological

For Ext the situation is more complicated and necessitates discussing injective resolutions for the second factor. Since this will not be required for our discussion, we won't get into these matters.

Next, we observe that

(*) $\quad Ext^{0}_{\mathcal{O}}(M, N) \cong Hom_{\mathcal{O}}(M,N)$.

Proof. If $E_1 \to E_0 \to M \to 0$ is exact, then so is

$$0 \to Hom_{\mathcal{O}}(M,N) \to Hom_{\mathcal{O}}(E_0, N) \xrightarrow{\delta} Hom(E_1, N). \qquad Q.E.D.$$

$\ulcorner$ $Ext^{0}_{\mathcal{O}}(M,N) = H^0(Hom_{\mathcal{O}}(E.(M), N)) = \ker\delta = Hom_{\mathcal{O}}(M,N)$

Comment on $Tor^{\mathcal{O}}_{p+q+1}(M,N) \cong Tor^{\mathcal{O}}_{p+q+1}(N,M)$

It is valid for $p+q\geq 0$. For $p+q+1=0$,

$Tor^{\mathcal{O}}_0(M,N) = M\otimes N$, for

$$\longrightarrow E_1\otimes N \xrightarrow{\partial\otimes 1} E_0\otimes N \longrightarrow 0$$

$$\Rightarrow Tor^{\mathcal{O}}_0(M,N) = \frac{E_0\otimes N}{Im(\partial\otimes 1)} = H_0(E.(M)\otimes_{\mathcal{O}} N)$$

$$\cong \frac{E_0}{Im\,\partial}\otimes N$$

$$\frac{E_0\otimes N}{Im(\partial\otimes 1)} \underset{\psi}{\overset{\phi}{\rightleftarrows}} \frac{E_0}{Im\,\partial}\otimes N$$

$$(e_0\otimes n) + Im(\partial\otimes 1) \overset{\phi}{\longmapsto} e_0 + Im\,\partial\otimes n$$

$$(e_0\otimes n) + Im(\partial\otimes 1) \overset{\psi}{\longleftarrow} e_0 + Im\,\partial\otimes n$$

Refer to P136. Hu. Introduction to Homological Algebra.