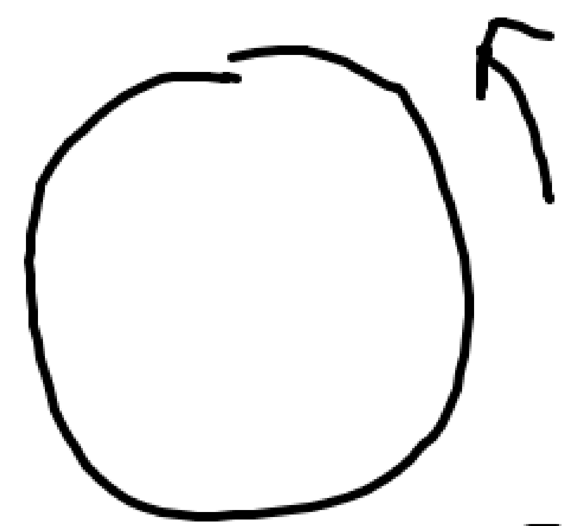
$T^{00} = E$ $\quad T^{0i} =$ Energy flux.

$T^{i0} =$ momentum density

$(0 \equiv t)$ $\quad \underline{T^{ij}} \Rightarrow$ Stress tensor.

$$dt^2 - dr^2 - r^2 d\theta^2 - dz^2$$

$(c = 1)$



$$\theta = \tilde{\theta} - \omega t$$

$$d\theta = d\tilde{\theta} - \omega\, dt \qquad \perp \quad \perp$$

$$\underbrace{(1 - r^2\omega^2)}\, dt^2 - dr^2 - 2 r^2 (dt\, d\tilde{\theta})$$

$$- r^2 d\tilde{\theta}^2 - dz^2$$

$$\underline{r}^2\, dt\, d\tilde{\theta} + \underline{r}^2\, d\tilde{\theta}\, dt$$

$\boxed{\phi = r^2 \omega^2}$

cont. force

Hole argument

$g_{\mu\nu}(\cdot)$

$\partial_t g_{\mu\nu}(0)$

t

$g_{\mu\nu}^{(t,x)} \longrightarrow \tilde{g}_{\mu\nu}(\tilde{t}, \tilde{x})$

(t, x)

$\longrightarrow \tilde{g}(t, x)$

Also soln in original coords.

Physical facts are important

$p = \gamma(\lambda)$ Nice

↑ Real.

$f(p) = \#$

assoc p

$f(p)$ nice.

exists + cont...

Nice

$f(\gamma(\lambda))$ $\dfrac{d}{d\lambda} f(\gamma(\lambda))$

$\gamma(\lambda)$, p $\gamma(\lambda_0) = p$ $f(p)$ $g(p)$

$$\frac{df}{d\lambda}(\gamma(\lambda))\Big|_{\lambda=\lambda_0} = dg(\gamma(\lambda))\Big|_{\lambda=\lambda_0} \quad \forall \gamma$$

through p.

at p, f, g rep same vector

$\cancel{\nabla f}$

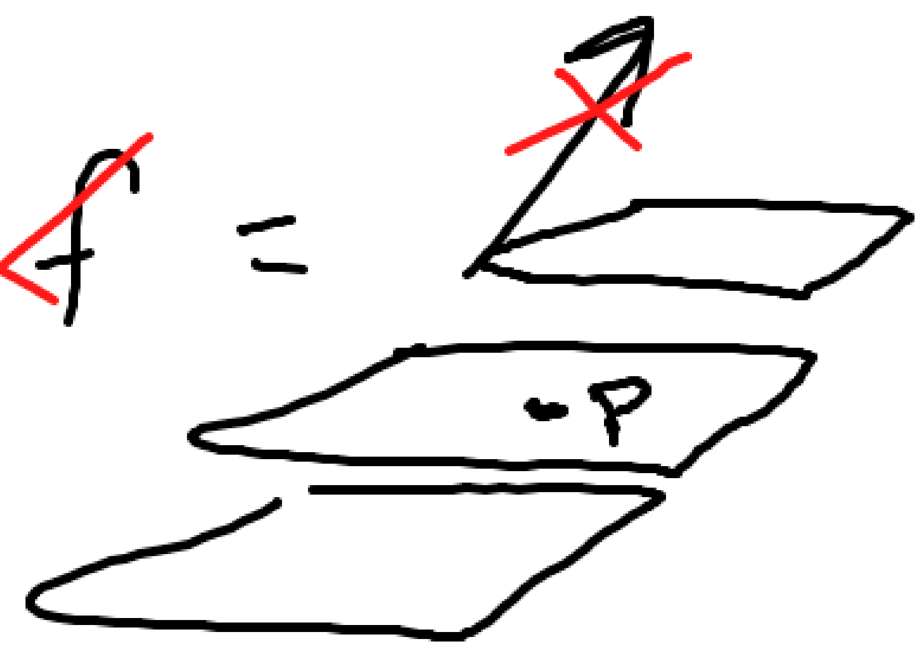
$df_A \Rightarrow$ equiv class of funct which same der. along any curve.

$h(p) = f(p) + g(p)$ $\quad \tilde{h} = c f(p)$

$dh_A = df_A + dg_A$ $\quad d\tilde{h} = c\, df_A$ $\quad$ Vector space

cotangent.

$\cancel{\nabla f} =$



Level surf

$\forall p \; f(p) = f(p_1)$

$df_A \longrightarrow$

$\gamma(\lambda)$, $\tilde{\gamma}(\lambda)$ $\quad \gamma(\lambda_0) = \tilde{\gamma}(\lambda_0) = P_0$

$$\frac{d}{d\lambda} f(\gamma(\lambda))\Big|_{\lambda=\lambda_0} = \frac{d}{d\lambda} f(\tilde{\gamma}(\lambda))\Big|_{\lambda=\lambda_0}$$

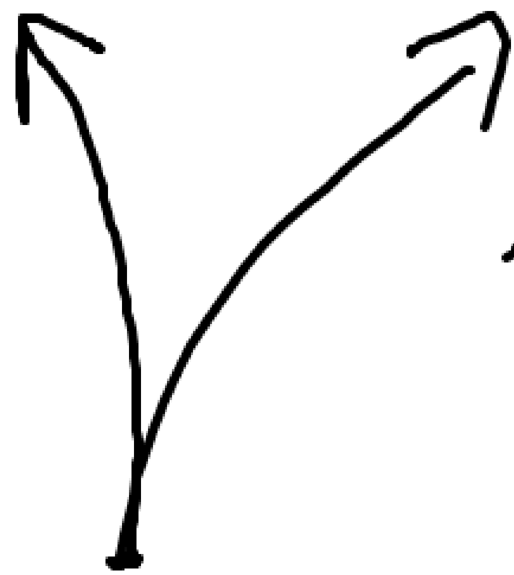
for all nice f.

$\gamma, \tilde{\gamma}$ have same "tangent vector" at $\lambda = \lambda_0$ on P_0

"How add curves?"

λ increases in dir of arrow

"length" $\quad \lambda_0, \lambda_0 + 1$



tangent → a small piece of a repres. curve.

$\frac{\partial}{\partial \gamma}^{A}$ ← tangent vector.

$$\frac{d}{d\lambda} f(\gamma(\lambda)) = \text{Vector (inner prod) of } df_A \frac{\partial}{\partial \gamma}^{A}$$

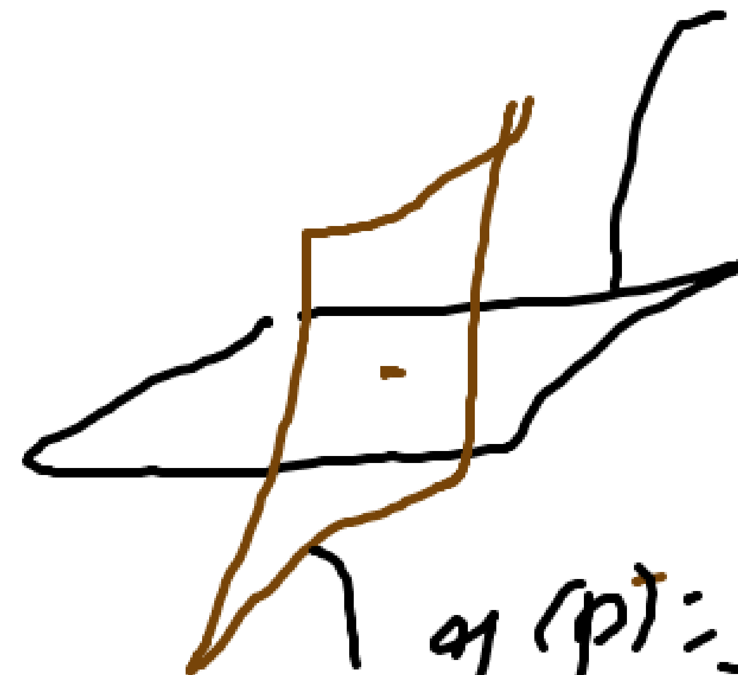
$\boxed{W_{A(T)} V^{A}_{(T)}}$ Products of Vectors

$\gamma(\lambda)$, $\gamma(\lambda_0 + s(\lambda - \lambda_0)) = \tilde{\gamma}(\lambda)$

$$\frac{\partial}{\partial \tilde{\gamma}}^A = s \frac{\partial}{\partial \gamma}^A$$

Coordinates

$f(p) = f(p_0)$



$g(p) = g(p_0)$

uniquely determine p?

$$f(p) = \#$$
$$g(p) = \tilde{\#}$$

$$df_A(p) \neq dg_A(p)$$

uniquely specify p.

Set of functs : coorinates

$N(p)$ is same for all p.

$x^i(p) \quad i = 0 \dots N$

$dx^i_A \rightarrow$ lin. indep

If I specify $N-1$ functs.

I get nice curve, $\gamma_i(\lambda) = p(x_0 \dots x_i = \lambda, \dots x_{N-1})$

$\gamma_i(\lambda)$ are nice curves.

Diff. manifold.