Example 7 Export to C-code

```python
def write_code (obj,name,filename,rank):

    import os

    from sympy.printing.ccode import C99CodePrinter as printer
    from sympy.printing.codeprinter import Assignment

    idx=[]  # indices in the form [{x, x}, {x, y} ...]
    lst=[]  # corresponding terms [termxx, termxy, ...]

    for i in range( len(obj[rank]) ):                    # rank = number of free indices
        idx.append( str(obj[rank][i][0]._sympy_()) )  # indices for this term
        lst.append( str(obj[rank][i][1]._sympy_()) )  # the matching term

    mat = sympy.Matrix([lst])                          # row vector of terms
    sub_exprs, simplified_rhs = sympy.cse(mat)         # optimise code

    with open(os.getcwd() + '/' + filename, 'w') as out:

        for lhs, rhs in sub_exprs:
            out.write(printer().doprint(Assignment(lhs, rhs))+'\n')

        for index, rhs in enumerate (simplified_rhs[0]):
            lhs = sympy.Symbol(name+' '+(idx[index]).replace(', ',']['))
            out.write(printer().doprint(Assignment(lhs, rhs))+'\n')
```

```
1    {\theta, \varphi}::Coordinate.
2    {a,b,c,d,e,f,g,h#}::Indices(values={\theta, \varphi}, position=independent).
3
4    \partial{#}::PartialDerivative.
5
6    g_{a b}::Metric.
7    g^{a b}::InverseMetric.
8
9    Gamma := \Gamma^{a}_{f g} -> 1/2 g^{a b} (   \partial_{g}{g_{b f}}
10                                              + \partial_{f}{g_{b g}}
11                                              - \partial_{b}{g_{f g}} ).
12
13   Rabcd := R^{d}_{e f g} ->   \partial_{f}{\Gamma^{d}_{e g}}
14                             - \partial_{g}{\Gamma^{d}_{e f}}
15                             + \Gamma^{d}_{b f} \Gamma^{b}_{e g}
16                             - \Gamma^{d}_{b g} \Gamma^{b}_{e f}.
17
18   Rab := R_{a b} -> R^{c}_{a c b}.
19
20   gab := { g_{\theta \theta}   = r**2,
21            g_{\varphi \varphi} = r**2 \sin(\theta)**2 }.    # cdb(ex-07.101,gab)
22
23   complete (gab, $g^{a b}$)                                 # cdb(ex-07.102,gab)
24
25   substitute (Rabcd, Gamma)
26   substitute (Rab, Rabcd)
27
28   evaluate    (Gamma, gab, rhsonly=True)                    # cdb(ex-07.103,Gamma)
29   evaluate    (Rabcd, gab, rhsonly=True)                    # cdb(ex-07.104,Rabcd)
30   evaluate    (Rab,   gab, rhsonly=True)                    # cdb(ex-07.105,Rab)
31
32   write_code (Gamma[1],'myGamma','example-07-gamma.c',3)
33   write_code (Rabcd[1],'myRabcd','example-07-rabcd.c',4)
34   write_code (Rab[1],  'myRab',  'example-07-rab.c',2)
```

$$\left[g_{\theta\theta} = r^2, \; g_{\varphi\varphi} = r^2(\sin\theta)^2\right] \tag{ex-07.101}$$

$$\left[g_{\theta\theta} = r^2, \; g_{\varphi\varphi} = r^2(\sin\theta)^2, \; g^{\theta\theta} = r^{-2}, \; g^{\varphi\varphi} = \left(r^2(\sin\theta)^2\right)^{-1}\right] \tag{ex-07.102}$$

$$\Gamma^a{}_{fg} \to \Box_{fg}{}^a \begin{cases} \Box_{\varphi\theta}{}^{\varphi} = (\tan\theta)^{-1} \\ \Box_{\theta\varphi}{}^{\varphi} = (\tan\theta)^{-1} \\ \Box_{\varphi\varphi}{}^{\theta} = -\dfrac{1}{2}\sin(2\theta) \end{cases} \tag{ex-07.103}$$

$$R^d{}_{efg} \to \Box_{eg}{}^d{}_f \begin{cases} \Box_{\varphi\varphi}{}^{\theta}{}_{\theta} = (\sin\theta)^2 \\ \Box_{\theta\varphi}{}^{\varphi}{}_{\theta} = -1 \\ \Box_{\varphi\theta}{}^{\theta}{}_{\varphi} = -(\sin\theta)^2 \\ \Box_{\theta\theta}{}^{\varphi}{}_{\varphi} = 1 \end{cases} \tag{ex-07.104}$$

$$R_{ab} \to \Box_{ab} \begin{cases} \Box_{\varphi\varphi} = (\sin\theta)^2 \\ \Box_{\theta\theta} = 1 \end{cases} \tag{ex-07.105}$$