Example 7 Export to C-code

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

   import os

   from sympy.printing.c import C99CodePrinter as printer
   from sympy.codegen.ast 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')
```

```
{\theta, \varphi}::Coordinate.
{a,b,c,d,e,f,g,h#}::Indices(values={\theta, \varphi}, position=independent).

\partial{#}::PartialDerivative.

g_{a b}::Metric.
g^{a b}::InverseMetric.

Gamma := \Gamma^{a}_{f g} -> 1/2 g^{a b} (   \partial_{g}{g_{b f}}
                                          + \partial_{f}{g_{b g}}
                                          - \partial_{b}{g_{f g}} ).

Rabcd := R^{d}_{e f g} ->   \partial_{f}{\Gamma^{d}_{e g}}
                          - \partial_{g}{\Gamma^{d}_{e f}}
                          + \Gamma^{d}_{b f} \Gamma^{b}_{e g}
                          - \Gamma^{d}_{b g} \Gamma^{b}_{e f}.

Rab := R_{a b} -> R^{c}_{a c b}.

gab := { g_{\theta \theta}   = r**2,
         g_{\varphi \varphi} = r**2 \sin(\theta)**2 }.   # cdb(ex-07.101,gab)

complete (gab, $g^{a b}$)                                # cdb(ex-07.102,gab)

substitute (Rabcd, Gamma)
substitute (Rab, Rabcd)

evaluate   (Gamma, gab, rhsonly=True)                    # cdb(ex-07.103,Gamma)
evaluate   (Rabcd, gab, rhsonly=True)                    # cdb(ex-07.104,Rabcd)
evaluate   (Rab,   gab, rhsonly=True)                    # cdb(ex-07.105,Rab)

write_code (Gamma[1],'myGamma','example-07-gamma.c',3)
write_code (Rabcd[1],'myRabcd','example-07-rabcd.c',4)
write_code (Rab[1],  'myRab',  'example-07-rab.c',2)
```

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

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

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

$$R^{d}{}_{efg} \to \square_{eg}{}^{d}{}_{f} \begin{cases} \square_{\varphi\varphi}{}^{\theta}{}_{\theta} = \left(\sin\theta\right)^2 \\ \square_{\theta\varphi}{}^{\varphi}{}_{\theta} = -\,1 \\ \square_{\varphi\theta}{}^{\theta}{}_{\varphi} = -\left(\sin\theta\right)^2 \\ \square_{\theta\theta}{}^{\varphi}{}_{\varphi} = 1 \end{cases} \tag{ex-07.104}$$

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